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No. 1.—*Reports on the Results of Dredging under the Supervision of* ALEXANDER AGASSIZ, *in the Gulf of Mexico,* 1877–78, *by the United States Coast Survey Steamer "Blake,"* LIEUT.-COMMANDER C. D. SIGSBEE, U. S. N., Commanding, *and in the Caribbean Sea,* 1878–79, *by the U. S. C. S. S. "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XIV.

Description sommaire des Espèces nouvelles d'Astéries, par EDMOND PERRIER, *Professeur au Jardin des Plantes de Paris.*

NOTA. — Dans toutes les descriptions, R désigne la distance du centre de la bouche à l'extrémité d'un bras ; *r*, la distance du centre de la bouche au sommet de l'angle ou de l'arc interbranchial ; *d*, la distance entre les pointes des deux bras consécutifs.

GENRE ASTERIAS (LINNÉ).

Asterias contorta (ED. PERRIER).

Espèce voisine d'aspect de l'*Asterias glacialis* des côtes de France. Elle possède comme elle cinq bras de longueur moyenne, présentant chacun une rangée dorsale médiane de piquants assez longs et pointus, deux rangées latérales, l'une à droite, l'autre à gauche de piquants semblables limitant la face dorsale des bras et sur la face ventrale, à peu de distance des piquants qui bordent la gouttière ambulacraire, une double rangée moins régulière de piquants un peu plus petits ; comme chez l'*Asterias glacialis* tous les piquants sont entourés d'un bourrelet portant un nombre considérable de pédicellaires croisés tandis que de grands pédicellaires droits, isolés, sont disséminés entre eux. Mais les piquants qui bordent la gouttière ambulacraire sont sur deux rangées, au lieu d'être sur une seule, comme chez l'*Asterias glacialis*. De plus entre les piquants ambulacraires et la double rangée de piquants ventraux, on voit chez l'*Asterias contorta* une série longitudinale de *gros tentacules isolés*, tandis que dans l'*Asterias glacialis*, on trouve à la place une série de *bouquets de tentacules* comme sur la face dorsale.

Asterias fascicularis (nov. sp.).

Cinq bras, assez allongés, légèrement renflés à la base. R = 57 mm., *r* = 9 mm., R > 6 *r*. Sillon ambulacraire assez large bordé par une double rangée de piquants assez allongés, obtus, contigus les uns aux autres ; piquants de la seconde rangée exactement superposés à ceux de la première et se renversant assez souvent sur la face ventrale des bras, tandis que les piquants internes se rabattent sur la gouttière ambulacraire. Du sommet de chacun des angles buccaux partent des piquants semblables qui se rabattent sur la bouche.

A très peu de distance des sillons ambulacraires viennent successivement deux rangées de piquants isolés un peu plus gros que les piquants de la seconde rangée; entre deux piquants consécutifs de la seconde rangée, on trouve en général intercalé un assez gros pédicellaire croisé. Ces deux rangées de piquants peuvent être considérées comme appartenant à la face ventrale. La charpente dorsale des bras est formée par environ sept rangées d'ossicules alternes, laissant entre eux des espaces membraneux dont le diamètre est moins grand que le leur et dans lesquels on aperçoit généralement deux tentacules ; sur les bords de chacun de ces espaces membraneux se trouvent deux ou trois pédicellaires croisés isolés. Les ossicules qui occupent la ligne médiane des bras portent en général de trois ou quatre piquants courts, mousses, disposés en arc transversal ; les autres ossicules portent un ou deux piquants semblables sur leur partie médiane et quelquefois aussi près de leur extrémité, de sorte qu'on trouve des piquants non seulement dans l'intervalle des huit rangées d'aires membraneuses, mais aussi sur les trabécules transverses qui séparent les uns des autres les aires d'une même rangée. Ces piquants courts et obtus tous semblables entre eux forment ainsi un grand nombre de rangées irrégulières.

Les piquants du disque qui est petit et auquel les bras s'attachent en se retrécissant sont semblables à ceux des bras, on aperçoit entre eux un petit nombre de grands pédicellaires droits à branches courbes et ne se touchent que par leur extrémité. Ces pédicellaires de forme ovalaire sont très caractéristiques ; leur pièce basilaire est moins larges que les deux branches de la pince.

La plaque madréporique est petite, arrondie, marquée de larges sillons rayonnants, elle est placée à l'angle des deux bras.

Asterias linearis (nov. sp.).

Cinq bras, étroits, anguleux. Un seul rang de piquants ambulacraires droits, aussi large au sommet qu'à la base, serrés.—Face ventrale très-étroite armée de piquants obtus, formant trois rangées irrégulières à la base des bras—piquants de la rangée externe formant la carène latérale. Face dorsale des bras formée par trois rangées de plaques, dont chacune porte un long piquant. Ces piquants forment donc trois rangées dont une médiane et deux latérales, formant le bord même du bras. Chaque piquant est entouré à sa base de plusieurs cercles de pédicellaires croisés.

Entre la rangée latérale et la rangée ventrale de piquants les tubes tentaculaires sont gros et isolés : ils sont petits et disposés par groupes entre la rangée latérale et la rangée médiane de piquants.

Il existe sur le disque quelques pédicellaires droits, épars, de forme allongée.

$R = 50$ mm., $r = 5$ mm., $R = 10\,r$, $d = 8$ mm.

Asterias angulosa (nov. sp.).

Cinq bras, allongés, relativement grêles et pointus, sur un échantillon désseché R = 43 mm., *r* = 6 mm., R = 7 *r*. Largeur des bras à la base (non compris les épines) = 7 mil. Sillon ambulacraire large; face ventrale très étroite; faces latérales presque verticales; arête médiane dorsale très marquée; de ces dispositions résulte pour les bras une section pentagonale très-nettement accusée.

Plaques interambulacraires portant chacune deux piquants grêles, allongés presque cylindriques dont l'ensemble forme une double rangée parfaitement régulière; dans chaque rangée les piquants à cause de leur minceur paraissent cependant peu serrés; les piquants portent, en général, un pédicellaire droit de forme allongée; ceux qui correspondent aux piquants internes s'insèrent dans le sillon ambulacraire. Les plaques ventrales sont plus longues que larges; elles portent chacune deux longs piquants pointus, insérés sur une ligne très oblique par rapport à l'axe des bras; les piquants forment encore une double rangée régulière séparée de la rangée de piquants interambulacraires par une bande très étroite dans laquelle, avec quelques piquants isolés et plus courts que leurs voisins, se trouve une rangée de pédicellaires droits de même forme que ceux du sillon ambulacraire. Il existe, en général, un de ces pédicellaires à la base de chaque couple de piquants. Le piquant externe est entouré du côté externe d'une demi couronne de pédicellaires croisés; on trouve aussi quelquefois dans son voisinage un ou deux pédicellaires droits. Les plaques latérales presque verticales sont très élargies de la base au sommet; elles s'imbriquent par leur partie élargie de la base au sommet du bras. Cette partie élargie porte toujours un piquant isolé, long, grêle et pointu, entouré à sa base d'une couronne de pédicellaires croisés. L'espace libre entre les bases rétrécies de ces plaques est occupé par une aire porifère ne contenant qu'un petit nombre (un à trois) de tubes tentaculaires. Le squelette dorsal est formé par des bandes presque parallèles de deux ou trois plaques calcaires aplaties et imbriquées unissant chaque plaque latérale à une plaque correspondante de l'arête dorsale: d'où il suit que les plaques de l'arête dorsale, les bandes costiformes qui en partent les plaques latérales et même les plaques ventrales sont en même nombre. Ces bandes costiformes sont séparées par des espaces vides de même largeur qu'elles allongés transversalement et où ne parait avoir existé qu'un très petit nombre de tubes tentaculaires (probablement un à chaque extrémité). Les bandes costiformes sont inermes, sauf quelques unes de la région moyenne des bras qui portent chacune en leur milieu un petit piquant pointu, entouré à sa base d'un cercle de pédicellaires croisés. Dans ce cas la région moyenne de la bande s'élargit de manière à venir au contact des bandes voisines et à couper en deux l'aire porifère. Toutes les plaques formant l'arête médiane dorsale portent un piquant long et pointu entouré à sa base de pédicellaires croisés. Chaque bras présente donc en tout trois rangées de piquants; une dorsale et médiane et deux latérales; plus quelquefois le rudiment d'une rangée intercalcaire à la base des bras, les bandes costiformes s'élargissent de manière à former autour du disque un cercle calcaire relié par cinq rayons correspondant au milieu des bras aux plaques entourant l'anus. La plaque madréporique petite et peu sillonnée est avec ce cercle osseux sur le disque, on ne voit qu'un petit nombre de piquants extrémités de pédicellaires droits.

Asterias gracilis (nov. sp.).

Six bras, assez allongés, grêles, pointus, inégaux; trois d'entre eux situés d'un même côté, plus grands que les trois autres (sur les quatre échantillons que j'ai pu examiner). Sur l'échantillon dans l'alcool $R = 15$ mm., $r = 3$ mm., $R = 5\,r$. R étant mesuré sur le plus grand bras le rapport $\frac{R}{r}$ est un peu plus grand chez l'individu dêsseché. Piquants ambulacraires disposés sur deux rangs, égaux entre eux. Au devant de cette double rangée on aperçoit une rangée de petits pédicellaires droits, émergeant du fond de la gouttière ambulacraire. En dehors des piquants interambulacraires, sur les faces latérales, on aperçoit une double rangée de piquants aplatis, à bords parallèles ou légèrement élargis au sommet, brusquement tronqués, finement striés, divergents, plus longs et plus larges que les piquants interambulacraires auxquels ils font immédiatement suite. Ces piquants sont entourés en dehors d'un demi cercle de pédicellaires croisés. Un assez grand nombre de ces pédicellaires se voient dans l'espace qui séparent ces piquants des premiers piquants dorsaux. Ceux-ci sont beaucoup plus courts presque cylindriques, finement striés et légèrement épineux au sommet. Ils sont nombreux et disposés sans ordre sur les ossicules qui limitent les aires porifères; mais celles-ci sont disposées au contraire fort régulièrement; elles constituent six rangées longitudinales alternes, dans chacune desquelles les aires sont séparées par des ossicules transversaux couverts de piquants et de pédicellaires, leurs têtes élargies constituent les bandes solides de séparation entre les rangées d'aires porifères. Celles-ci ont un diamètre plus grand que la largeur des ossicules qui les séparent, entre les piquants qui naissent des parties solides des bras on voit un assez grand nombre de pédicellaires croisés qui ne se disposent pas nettement en cercle autour de leur base, sur la base des bras et sur le disque, où les aires porifères cessent de présenter un ordre déterminé et où les piquants sont plus nombreux; à ces pédicellaires croisés s'ajoutent des pédicellaires droits, relativement grands, une fois et demie plus longs que larges, et dont les deux branches laissent entre elles, à leur insertion sur la pièce basilaire, un écartement très sensible.

Sur aucun des quatre échantillons que j'ai cependant examinés avec soin, je n'ai pu distinguer de plaque madréporique; trois des échantillons de Sand Key (Floride), à 120 et 129 brasses de profondeur, l'autre de Tennessee Reef (Floride), à 174 brasses.

GENRE ZOROASTER (Wyville Thomson).

Zoroaster Sigsbeei (nov. sp.).

Cinq bras; ambulacres quadrisériés à la base des bras, bisériés dans le dernier tiers de leur longueur, à ventouse très-petite, beaucoup moins large que le tube ambulacraire quand celui-ci est contracté. Tubes ambulacraires très serrés les uns contre les autres; gouttière ambulacraire étroite à bords échancrés au devant de chaque tube ambulacraire. Chacun des tubes se trouve ainsi placé dans une sorte de loge semi-circulaire dont les bords saillants le séparent de ses voisins; ces parties saillantes sont armées chacune d'un piquant comprimé, courbe, assez semblable aux piquants qui occupent la même position chez les *Astropecten*. Sur le dos de ce piquant se trouve, en général, un pédicellaire droit; sur le bord de la gouttière les pédicellaires semblent donc alterner avec les tubes ambulacraires. Toute la face ventrale est uniformément recouverte de petits piquants très serrés couchés sur la surface du corps et dirigés vers l'intérieur des bras. Parmi eux se trouve quelques piquants isolés, plus grands, assez régulièrement espacés, correspondant à peu près aux piquants de la gouttière ambulacraire. De chaque angle interbrachial 3 ou 4 piquants aigus se projettent au-dessus de l'orifice buccal. La face dorsale des bras et le disque sont dépourvus de piquants. La partie supérieure des bras est formée de cinq rangées régulières de plaques calcaires légèrement bombées, très serrées laissant entre elles des sillons longitudinaux un peu enfoncés, occupés par les apophyses latérales des plaques, qui circonscrivent des orifices par où faisaient probablement saillie chez l'animal vivant des tubes tentaculaires. Le disque est formé d'une plaque centrale autour de laquelle se disposent: 1° un cercle de cinq plaques interbrachiales. 2° un second cercle de cinq plaques correspondant aux bras et séparées les unes des autres par les premières qui font saillie entre elles. 3° un cercle de dix plaques situées deux par deux dans l'intervalle des bras, plus petits que les précédents. 4° un cercle de quinze plaques disposées trois par trois à la base des bras et dont la médiane, plus grande, sépare les unes des autres les cinq couples de plaques du cercle précédent auxquelles sont contigus les deux autres plaques. Le disque se trouve donc formé de 36 plaques toutes convexes, bien nettement séparées les unes des autres et circonscrivant des pores isolés par chacun desquels fait saillie un tube tentaculaire. Quelques petits pédicellaires droits sont disséminés en ces plaques.

La plaque madréporique convexe, arrondie est située entre le premier cercle de cinq plaques et le cercle des dix plaques interbrachiales.

Il existe un anus bien visible entre la plaque centrale et les plaques du premier cercle, vis-à-vis de l'un des angles interbrachiaux, contigu à celui où se trouve la plaque madréporique.

Bras étroits, grêles, allongés. $R = 49$ mm., $r = 7$ mm., $R = 7r$, $d = 6$ mm.

Nota: pas de pédicellaires croisés.

Zoroaster Ackleyi (nov. sp.).

Cette espèce est bien nettement distincte du *Zoroaster Sigsbeei*, comme aussi du *Zoroaster fulgens*. Son aspect rappelle beaucoup plus l'aspect d'un *Ophidiaster* ou même celui d'un *Chætaster*, surtout lorsqu'on examine la face inférieure des bras.

Les bras sont beaucoup plus allongés et le disque proportionnellement plus petit que celui du *Zoroaster Sigsbeei*.

$R = 110$ mm., $r = 9$ mm., $R = 12.2\,r$, $d = 9$ mm. à la base.

Les bras ne diminuent pas graduellement d'épaisseur de la base au sommet comme chez le *Zoroaster Sigsbeei*. Ils conservent à peu près sensiblement le même diamètre jusque vers le premier tiers de leur longueur, ou même se renflent légèrement dans cette région, puis diminuent peu à peu sans cependant devenir aussi effilés que ceux du *Z. Sigsbeei*.

Leur squelette est aussi beaucoup moins compact, il est formé d'un beaucoup plus grand nombre d'ossicules plus petits ; on compte jusqu'à 17 rangées longitudinales de ces ossicules tandis qu'il n'en existe que neuf dans l'autre espèce. Il en résulte que les bras sont beaucoup plus faciles à déformer et sont courbés en sens divers chez les individus conservés dans l'alcool, au lieu de présenter la rigidité et la netteté de forme si frappantes chez les *Zoroaster Sigsbeei* et *fulgens*. Les ossicules du disque ne se renflent pas comme chez la première de ces espèces de manière à faire une forte saillie au-dessus des bras et à en séparer nettement le disque. Les plaques des bras et du disque sont uniformément couvertes de piquants articulés très-petits et dans leurs intervalles se trouvent des pédicellaires droits. Sur la face ventrale les piquants deviennent beaucoup plus allongés, plus pointus et chaque plaque en porte à son centre un certain nombre qui sont plus grands et plus forts que ceux qui sont situés sur ses bords ; l'ensemble de ces piquants forme à la face ventrale un revêtement assez semblable à celui qu'on observe chez les *Luidia*. La ressemblance est encore augmentée parce que chacune des plaques adambulacraires, au lieu de porter un seul piquant marginal droit, comme chez les *Asterias*, porte une rangée de piquants dont la direction est perpendiculaire à celle de la gouttière ambulacraire qui s'avance jusqu'à cette gouttière et sont comprimés et recourbés en lame de sabre, exactement comme chez les *Luidia*. Parmi ces piquants se trouvent en assez grand nombre des pédicellaires droits.

Les tubes ambulacraires sont disposés sur quatre rangées à la base des bras ; mais il finissent par n'être plus que sur deux rangées à l'extrémité ; ils sont remarquables, comme chez les *Zoroaster Sigsbeei*, par la petitesse de leur ventouse terminale ; c'est encore un caractère qui rapproche ces singuliers animaux des *Astropectinidæ* et notamment de *Luidia*.

La plaque madréporique est petite et largement sillonnée. La bouche est petite ; les angles buccaux presque contigus et armés de piquants assez forts.

GENRE PEDICELLASTER (Sars).

Pedicellaster Pourtalesi (Edm. Per.).

Cinq bras, grêles, allongés, presque cylindriques, obtus au sommet.

$R = 21$ mm., $r = 4$ mm., $R > 5\,r$.

Le diamètre des bras près de leur base est d'environ 3 mm.

Les tubes ambulacraires sont disposés sur deux rangs seulement et terminés par une ventouse bien conformée.

La gouttière ambulacraire occupe presque toute la face ventrale des bras.

Les plaques adambulacraires sont assez larges et portent chacune deux ou trois piquants coniques, grêles, assez longs, placés en rangée transversale. La face dorsale est constituée par un réseau d'ossicules qui forment seulement trois rangées régulières, une qui occupent la ligne médiane dorsale, et deux latérales. Ces trois rangées sont reliées entre elles par des ossicules irrégulièrement disposés, tous ces ossicules portent un petit piquant; dans les intervalles des piquants se trouvent des pédicellaires croisés isolés et parfaitement caractérisés.

L'anus, très visible, est subcentral ; la plaque madréporique, petite, difficile à distinguer, marquée de larges sillons rayonnants est située tout au bord du disque dans l'intervalle de deux bras. Les bras sont à leur base d'une fragilité extrême. Les pièces dentaires sont formées par les plaques ambulacraires et portent chacune deux piquants dirigés vers la bouche.

GENRE ECHINASTER (Müller & Troschel).

Echinaster modestus (Ed. P.).

Cinq bras : $R = 36$ mm., $r = 6$ mm., $R = 6\,r$.

Ses bras deviennent proportionnellement plus gros et plus courts chez les petits échantillons. Plaques adambulacraires portant chacune dans la gouttière ambulacraire, un piquant gros, court, cylindrique, obtus, renforcé intérieurement d'un piquant aussi gros mais un peu plus court et quelquefois d'un certain nombre de piquants plus petits, placés transversalement sur la plaque les uns derrière les autres. Vient ensuite une rangée assez régulière de piquants qui s'arrêtent généralement vers le milieu de la longueur des bras; puis d'un bord à l'autre des bras, neuf rangées assez régulières de petits piquants entre lesquelles se trouvent parfois disséminés d'autres piquants irrégulièrement disposés — ossicules du squelette formant un réseau irrégulier, à larges mailles sur les nœuds duquel sont placés les piquants. Dans les mailles du réseau se trouvent trois ou quatre tubes tentaculaires. Les téguments sont épais; la plaque madréporique est petite, saillante, arrondie, marquée de sillons rayonnants assez fins. L'anus est bien visible près du centre du disque et entouré de petits piquants.

GENRE CRIBRELLA.

Cribrella antillarum (Ed. P.).

Cinq bras, allongés, pointus, flexibles dans tous les sens à l'état vivant et se contournant de toute façons dans l'animal dessceché ou conservé dans l'alcool.

R = 42 mm., *r* = 7 mm., R = 6 *r*.

Plaques adambulacraires petites, mais bien distinctes, rectangulaires et allongées perpendiculairement au sillon ambulacraire, couvertes de petits piquants assez pointus mais peu saillants et serrés de manière à former une sorte de granulation, ces piquants deviennent brusquement plus grands au voisinage du sillon ambulacraire et forment deux ou trois rangées irrégulières de piquants serrés à chacune desquelles chaque plaque fournit deux ou trois piquants, deux ou trois de ces piquants occupent le bord libre de la plaque et forment l'armature ambulacraire proprement dite. La face ventrale est formée par des rangées de petites plaques rectangulaires qui deviennent de moins en moins régulières à mesure que l'on s'éloigne de la gouttière ambulacraire. Les plaques de la première rangée correspondent exactement aux plaques ambulacraires et les plaques des rangées suivantes correspondent aussi à peu près à celles des rangées adjacentes, et par conséquent à celles des rangées adambulacraires. On peu compter cinq de ces rangées à la base des bras, mais elles se réduisent rapidement à trois. Toutes les plaques qui les composent sont couvertes d'une granulation serrée et formée de piquants un peu plus petits et moins pointus que ceux des plaques adambulacraires. Les pièces dentaires ne sont pas saillantes; elles sont petites et bordées chacunes à l'angle buccal de trois ou quatre piquants un peu plus gros que leurs voisins, cylindriques et arrondis au sommet; leur surface porte quelques piquants de forme ordinaire.

La surface dorsale est formée d'un réseau serré d'ossicules finement granuleux, réseau semblable à celui qui forme la face dorsale des autres *Cribrelles*. Les mailles de ce réseau ont un diamètre un peu plus petit que celui des ossicules et offrent chacune un pore. L'anus est subcentral, entouré de piquants un peu plus grands que leur voisins. La plaque madréporique est grande, située au milieu de la distance qui sépare le centre du disque du sommet de l'angle interbrachial correspondant, elle est couverte de granules semblables à ceux des ossicules dorsaux et distincte seulement, en conséquence, par la disposition un peu spéciale de ses granules et par la saillie qu'elle fait sur le disque.

Cribrella sex-radiata (Ed. P.).

Cette espèce, voisine de la précédente par les caractères de sa face ventrale, en diffère très nettement par les proportions de ses bras plus-courts et plus obtus et surtout par leur nombre de six, tout-à-fait exceptionnel chez les *Cribrelles*. Elle jouit aussi de la faculté de reproduction par division en deux moitiés que la présentent plusieurs *Asterias* à bras nombreux, diverses *Linckia* et quelques *Asterina*.

Des trois échantillons que j'ai sous les yeux, un seul, en effet, possède six bras égaux. Chez les autres, trois bras sont à peu près de même taille et trois considérablement plus petits, sont évidemment de nouvelle formation et destinés à remplacer ceux qu'ont dû précédemment se détacher. La répétition de ce même phénomène, dans les mêmes conditions, chez deux exemplaires sur trois indique bien qu'il ne doit pas être accidentel. Voici la description de l'individu le plus complet qui est aussi le plus grand.

Six bras, relativement courts et obtus : $R = 18$ mm., $r = 4$ mm., $R = 4.5\,r$.

Plaques adambulacraires rectangulaires, allongées perpendiculairement au sillon ambulacraire, couvertes de granules serrées obtus, qui grandissent brusquement sur le bord libre de la plaque de manière à former deux rangées de petits piquants obtus ; à la plus externe de ces deux rangées chaque plaque fournit trois piquants, et deux seulement à la plus interne qui est tout-à-fait sur le bord de la gouttière ambulacraire. La face ventrale est formée de rangées régulières de plaques rectangulaires au nombre de trois à la base des bras, de deux à partir du milieu de la longueur, la rangée intermédiaire disparait graduellement.

Ces plaques se correspondent dans chaque série, et correspondent aux plaques adambulacraires ; elle sont couvertes d'une granulation serrée et régulière.

La face dorsale est composée du réseau d'ossicules ordinaire chez les Cribrelles, les ossicules de ce réseau sont couverts de granules plus fins encore que ceux de la face ventrales. Les mailles du réseau sont de plus petite dimension que les ossicules eux-mêmes, et ne présentent qu'un seul pore tentaculaire.

Comme chez la plupart des espèces où existe la reproduction par division ; on observe sur la face dorsale deux plaques madréporiques. Ces plaques, assez petites, arrondies, couvertes de granules, sont situées à droite et à gauche d'un même bras et près du sommet des angles interbrachiaux correspondants.

GENRE OPHIDIASTER (Müller & Troschel).

Ophidiaster Floridæ (nov. sp.).

Cinq bras courts, coniques et obtus au sommet. $R = 33$ mm., $r = 9$ mm., $R = 3.7\,r$. Largeur des bras à leur base $= 10$ mm. à 5 mm. du sommet $= 415$ mm.

Face ventrale légèrement aplatie et formée comme chez les *Linckia*, par un petit nombre de rangées de plaques entre lesquelles on n'observe pas de pores tentaculaires et qui sont plus petites que les plaques marginales dorsales. La granulation générale, formée de grains arrondis, contigus, parfaitement réguliers et assez gros, empêche de distinguer le nombre de ces rangées et les limites des plaques qui les composent. Les piquants interambulacraires sont sensiblement disposés comme chez les autres espèces du genre *Ophidiaster ;* c'est-à-dire qu'en dehors des piquants qui sont implantés au bord même du sillon et qui sont ici tous égaux entre eux, on observe une rangée de piquants obtus, ovoïdes, beaucoup plus gros que les précédents ; on trouve deux de ces piquants pour quatre de la rangée précédente, deux piquants consécutifs de la rangée externe sont séparées par deux petits piquants aplatis semblables à ceux de la rangée interne et implantés obliquement. Ces deux rangées de piquants sont presque contiguës et beaucoup plus rapprochées par conséquent que dans la plupart des autres espèces d'*Ophidiaster.* Vers la base des bras à 1½ mm. en dehors de la rangée externe on observe une rangée de piquants exactement semblables à ceux qui la composent, mais qui ne dépasse guère le niveau de l'angle interbrachial et ne comprend que huit piquants au plus ; encore en dehors de cette rangée, également à une distance de 1½ mm. environ, on observe les indices d'une nouvelle rangée formée de semblables piquants, mais beaucoup plus courte. Cette multiplicité des rangées de piquants ventraux est encore un caractère exceptionnel, probablement en rapport avec le développement relativement grand de la face ventrale (dont la largeur ne dépasse pas toutefois 4½ mm. à la naissance des bras). La rangée moyenne (celle qui se compose de huit piquants environ) semble être prolongée par une rangée moins régulière et un peu plus interne de pédicellaires en salière construits sur le même type que ceux des autres *Ophidiaster.* Les cupules de ces pédicellaires qui sont à peine retrécies à leur base, peu saillantes, à bords lisses. Il en est de même des petites valves verticales qui se rabattent dans leur intérieur. Plusieurs de ces pédicellaires ont trois branches au lieu de deux.

Les faces dorsales et latérales sont formées par sept rangées parfaitement régulières d'ossicules allongés, ovalaires et non plus en forme de trèfle, comme chez la plupart des *Ophidiaster ;* ces ossicules recouverts d'une granulation semblable à celle de la face ventrale sont assez fortement saillants et bien distincts les uns des autres. Entre la première rangée latérale (plaques marginales ventrales des *Goniasteridæ*) et les plaques ventrales proprement dites, il n'existe pas d'aires porifères. Sur le reste des faces latérales et dorsales on trouve six rangées régulières d'aires porifères placées dans autant de sillons enfoncés séparant les sept rangées d'ossicules. Ces aires poriféres ne contiennent que de deux à quatre pores, assez espacés. Sur le disque, les ossicules affectent une disposition assez régulière. Autour d'un ossicule central se trouvent d'abord des ossicules peu visibles formant la surface d'un pentagone limité par dix ossicules plus gros, convexes, bien distincts, contigus, corrrespondant les uns à la ligne médiane des bras, les autres aux angles interbrachiaux. C'est en dehors de ces pentagones entre l'un de ses côtés et le sommet de l'un des angles interbrachiaux, que se trouve la plaque madréporique, en forme de triangle équilatéral et couverte de fins sillons rayonnants. Sur le disque les aires porifères sont peu distinctes.

Ophidiaster Agassizii (nov. sp.).

Cinq bras, presque cylindriques, s'amincissant seulement vers l'extrémité pour se terminer en pointe obtuse.

R = 70 mm., r = 10 mm., R = 7 r, d = 137 mm. Épaisseur des bras près de leur base = 12 mm., à 1 mm. de l'extrémité = 8 mm.

Piquants du sillon ambulacraire disposés, suivant la règle générale, en rangées distantes l'une de l'autre ; leur intervalle étant rempli par la granulation générale. Les piquants de la rangée interne sont cylindriques, égaux entre eux, et séparés par une rangée verticale de petits granules qui remplacent le petit piquant que l'on observe chez d'autres espèces et qui rappellent la disposition caractéristique chez certaines espèces de *Linckia* telles que la *L. multifora,* Lamarck et le *L. miliaris,* Lam. Les piquants de la seconde rangée sont courts, coniques, plus gros que ceux de la rangée interne, et plus espacés, de sorte que trois piquants de cette dernière correspondent à deux piquants seulement de la première. La granulation qui remplit l'intervalle de ces deux rangées de piquants est la même que la granulation générale ou du moins que la partie de cette granulation qui recouvre les séries de plaques constituant le squelette de l'animal. Le nombre de ces séries est de sept, dont une occupe la ligne médiane des bras; elles sont parfaitement régulières sauf dans quelques régions fort limitées où l'animal paraît avoir été blessé.

Ces plaques sont comme d'habitude en forme de trèfle dont le pédoncule serait coupé et le foliole médian tourné vers la base du bras et un peu plus grand que les folioles latérales. Les plaques de toutes ces séries se correspondent exactement et se touchent dans deux rangées consécutives par leur folioles latéraux, de sorte que le squelette peut tout aussi bien être décomposé en rangées transversales qu'en rangées longitudinales. Un léger sillon passant par la base des plaques d'une même rangée transversale s'observe sur tout le pourtour de bras auxquels ils donnent, au moins chez les individus desséchés, un aspect nettement annelé. Le nombre de ces rangées transversales de plaques est de 43 environ, à partir des sommets d'une sorte de pentagone que l'on observe sur le disque. A l'intérieur de ce pentagone les plaques, peu nombreuses, sont disposées irrégulièrement autour de l'anus. La plaque madréporique circulaire, petite, criblée plutôt que sillonnée est en dehors de ce pentagone et tout-à-fait marginale.

Les rangées de plaques longitudinales sont séparées par des rangées d'aires porifères au nombre de huit et dont les plus inférieures arrivent au contact des plaques interambulacraires. Chacune de ces rangées est composée d'aires elliptiques, distinctes les unes des autres, allongées tranversalement sur le dos et sur le côté, presque circulaires au voisinage des ambulacres et contenant chacune de 14 à 18 pores tentaculaires. La granulation qui recouvre ces aires est un peu plus fine que celle qui recouvre les plaques et qui est d'ailleurs parfaitement uniforme. C'est dans les aires poriferes, légèrement enfoncées par rapport aux rangées de plaques que l'on distingue les pédicellaires ; ceux-ci sont construits sur le type des *pédicellaires salières ;* mais ici les deux alvéoles sont larges à leur base, pointues à leur sommet, de sorte que leur ensemble a une forme exactement naviculaire. Une barrette transversale sépare comme d'habitude les deux alvéoles l'une de l'autre, et divise, par conséquent, la navette en deux moitiés symétriques. Chez l'*O. pyramidatus,* Gray, les pédicellaires présentent une forme à peu près semblable ; mais les bords de l'alvéole sont légèrement renflés aux deux extrémités de la barrette transversale ; les alvéoles se rétrécissent même un peu au voisinage de cette barrette ; ils sont aussi moins pointus de sorte que la forme naviculaire est beaucoup moins nette ; enfin ceux qui avoisinent le bord de la gouttière ambulacraire sont beaucoup plus gros que les autres, et leurs alvéoles beaucoup plus ronds, différence que l'on retrouve chez l'*O. Agassizii.*

Chez cette dernière espèce une seule aire porifère peut contenir cinq ou six pédicellaires; ceux-ci échapperaient facilement à l'attention si l'on n'était prévenu, parce qu'ils ne font pas saillie au-dessus de la granulation générale, qu'ils sont fort petits et que la moitié de leur alvéole peut être facilement confondue avec un des pores tentaculaires avoisinants.

La couleur paraît avoir été rougeâtre pendant la vie.

GENRE KORETHRASTER (Wyv. Thoms.).

Korethraster palmatus (nov. sp.).

Cinq bras courts, convexes en dessus, légèrement aplatis en dessous.

R = 47 mm., *r* = 14 mm., R = 3 *r*.

Angles interbrachiaux non arrondis. Tubes ambulacraires sur deux rangs, terminés par une ventouse de forme ordinaire, plaques adambulacraires petites, portant chacune un piquant dans le sillon ambulacraire. Face ventrale formée de 13 rangées longitudinales de petites plaques en rectangle allongé dans le sens transversal du bras, imbriquées d'une rangée à l'autre de telle façon que les plaques de la rangée la plus interne recouvrent le côté des plaques de la rangée à laquelle elles sont contigues. Chacune de ces plaques porte sur son bord libre parallèle au sillon ambulacraire un pinceau de piquants grêles, aplatis, qui semblent soudés entre eux et forment une lame mobile qui se rabat généralement vers le bord libre du bras.

Une quatrième rangée porte des pinceaux à peu près semblables qui forment aux bras une large bordure frangée. La face dorsale est formée d'ossicules quadrangulaires, échancrés sur leurs quatre côtés et se touchant par leurs sommets tronqués de manière à limiter entre eux un petit espace circulaire occupé par un tube tentaculaire. Chacun des ossicules porte à son centre un tubercule saillant, terminé par une tête arrondie et qui porte un large pinceau de dix à douze piquants grêles, pouvant avoir plus d'un millimètre de long, disposés en cercle sur la tête des tubercules et réunis entre eux par une membrane continue formant une sorte de corolle monopétale dont ils seraient les nervures.

Ces piquants peuvent s'écarter ou se rapprocher de telle façon que le corolle peut, à la volonté de l'animal, s'ouvrir ou se fermer.

Il existe entre les bras aussi bien sur le dos que sur le ventre, des sillons partant soit de la bouche soit du centre du disque et aboutissant aux angles interbrachiaux de façon que chaque bras est nettement séparé de ses voisins. La plaque madréporique petite, arrondie, marquée de vermiculations courtes et assez larges est très voisine de l'anus, comme chez les *Pteraster;* elle est à cheval sur l'un de ces sillons.

Korethraster radians (Ed. Per.).

Petite espèce à cinq bras, courts et obtus, aplatis en dessous, assez fortement convexes en dessus: R = 10 mm., *r* = 4 mm., R = 2.5 *r*.

Plaques ambulacraires portant chacune sur le bord même du sillon trois piquants assez courts et divergents ; plus, en dehors, sur la face ventrale, une rangée transversale de trois piquants également divergents, rangée qu'une étroite bande nue sépare du bord des bras qui est comme tranchant et frangé par les bouquets de piquants obtus que portent les plaques dorsales ; ossicules dorsaux supportent chacun un bouquet d'une douzaine de piquants assez courts, obtus au sommet, ou même légèrement capités, divergents, plus longs sur le bord des bras, irrégulièrement disposés à la surface des ossicules, mais de manière à en couvrir toute la surface.

Des pores tentaculaires isolés entre les ossicules dont on peut compter onze rangées peu régulières d'un bord à l'autre des bras.

Plaque madréporique arrondie convexe, assez petite, à demi cachée entre les piquants de la surface dorsale, située à la moitié de la distance entre le ventre du disque et le sommet de l'angle interbrachial.

GENRE PTERASTER (Müller & Troschel).

Pteraster caribbæus (nov. sp.).

Cinq bras : $R = 30$ mm., $r = 15$ mm.,* $R = 2\,r$.

Les tubes ambulacraires sont nettement sur deux rangs sur les grands exemplaires ; sur les petits ils sont plus serrés et un examen superficiel pourrait faire croire qu'ils sont disposés sur quatre rangs ; mais on reconnaît avec un peu d'attention que la disposition est toujours la même, ces tubes terminés par une large ventouse sont bisériés. Les pièces ambulacraires sont d'ailleurs élargies à leurs deux extrémités.

Les pièces adambulacraires qu'elles supportent sont irrégulièrement arrondies, larges, mais imbriquées de façon que leur tranche seule apparaît sur la face ventrale, où elle se montre comme un arc de cercle incliné de dedans en dehors et du sommet à la base du bras. Elle porte sept piquants divergents ; les six premiers croissent régulièrement de dedans en dehors ; le septième est beaucoup plus grand et dépasse la largeur des bras. Tous les piquants d'une même plaque sont unis entre eux par une membrane tendue comme celle de l'aile d'une chauve-souris. En outre une autre membrane unit entre eux l'ensemble des grands piquants qui occupent sur chaque plaque le septième rang ; les membranes unissant les autres piquants viennent s'attacher à celle-ci le long du grand piquant ; mais demeurent libres sur le reste de leur étendue. Les pièces dentaires sont constituées aux dépens des pièces adambulacraires, elles s'unissent en faisant sur la face ventrale une légère saillie conique. Chacune d'elles porte six piquants qui grandissent en se rapprochant du sommet de l'angle buccal. Celui qui occupe le sommet de cet angle est large, aplati.

Immédiatement en dehors des plaques adambulacraires et s'appuyant sur elles, viennent les ossicules qui forment tout le reste du squelette et qui sont très remarquables. Ce sont, en effet, des espèces d'étoiles à quatre branches obliques, légèrement élargies à leur extrémité libre et dont deux sont plus longues et deux plus courtes. Au point d'entre-croisement de ces branches, s'élève une tige calcaire, oblique également par rapport au plan de l'étoile, plus longue que les plus longues branches et terminée par une tête arrondie. De cette tête divergent des piquants longs et grêles au nombre de six ou sept pour chaque ossicule, formant une sorte de balai dont toutes les parties sont unies entre elles par une fine membrane; à leur extrémité libre ces petits balais arrivent à se toucher; et tous sont unis entre eux par une membrane continue, distante de la surface dorsale, formée par les ossicules. C'est cette membrane qui donne à l'animal sa forme presque pentagonale; en réalité les bras tels qu'ils sont limités par les ossicules sont distincts les uns des autres jusque près de la bouche, comme on peut s'en assurer sur des sujets déteriorés.

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* r est compté depuis le centre de la bouche jusqu'à l'angle de la membrane ventrale.

On ne peut apercevoir la plaque madréporique que sur des individus dont la membrane dorsale a été déchirée. Elle est arrondie, grande, bombée, très voisine de l'anus, sa surface est formée de sillons sinueux, fréquemment interrompus, de manière à isoler de petits îlots calcaires, irréguliers et saillants.

GENRE FROMIA (Gray).

Fromia Japonica (nov. sp.).

Cinq bras aplatis, ainsi que le disque, et terminés en pointe très obtuse.

$R = 32$ mm., $r = 7$ mm., $R = 4.7\ r$, $d = 65$ mm.

Piquants des sillons ambulacraires disposés sur deux rangés, la rangée externe étant assez irrégulière. Plaques interambulacraires portant deux très rarement trois piquants divergents et inégaux terminés en pointe très obtuse; assez distants les uns des autres. Ces piquants, qui forment la rangée interne, sont suivis des piquants formant la rangée externe. Ceux-ci sont également au nombre de deux par plaque, mais l'un d'entre eux demeure ordinairement rudimentaire et ne forme qu'une courte pointe, tandis que l'autre devient plus gros que les piquants internes et constitue un piquant conique dont la longueur ne dépasse pas celle de ces derniers. Les plaques interambulacraires sont suivies d'une rangée de plaques un peu plus longues que larges de forme sensiblement rectangulaire et qui correspondent chacune en général à deux plaques interambulacraires. La largeur de ces plaques devient de moins en moins grande à mesure que l'on se rapproche de l'extrémité des bras, et la rangée elle-même devient tout-à-fait indistincte à partir du dernier quart des bras. Dans la région interbrachiale, cette rangée est suivie d'une autre formée de plaques à peu près semblables au sept précédentes, mais diminuant plus rapidement de longueur. Cette rangée s'arrête à l'extrémité du premier tiers des bras et ne contient guère pour chacun d'eux que six à sept plaques de plus en plus petites à mesure que l'on s'approche de la fin de la rangée. Chacune d'elles, sauf la première, correspond à l'une des plaques de la rangée précédente; il n'y a pas de pores tentaculaires entre elles. Le système de ces deux rangées constitue le squelette ventral. Viennent ensuite les deux rangées de plaques latérales. La rangée inférieure est composée de dix-sept plaques pour chaque bras. Ces plaques sont plutôt elliptiques que rectangulaires à peu près deux fois aussi longues que larges et chacune d'elles correspond à deux des plaques de la rangée précédente.

Entre ces plaques et celle de la rangée ventrale, au bord inférieur des premières on trouve un pore tentaculaire isolé de telle sorte que deux pores consécutifs sont séparés par deux plaques ventrales et une latérale. On ne compte que six ou sept de ces pores à partir de la base des bras et quelques pores sporadiques isolés au nombre de deux ou trois tout au plus, se trouvent encore entre les deux rangées de plaques ventrales. Les plaques latérales de la rangée supérieure sont au nombre de quinze pour chaque bras. Leurs dimensions sont inégales, et une plaque plus petite sépare souvent deux plaques plus grandes, de sorte que le bord des bras prend un aspect légèrement moniliforme. Toute la surface du disque et la surface dorsale des bras sont constitués par des plaques aplaties de grandeur variable, sensiblement circulaires et autour desquelles sont distribués des pores tentaculaires isolés, équidistants au nombre de huit autour des plus grandes plaques. Sur les bras ces plaques peuvent être considérées comme formant trois rangées principales, d'ailleurs peu régulières ; quelques plaques intercalcaires plus petites se trouvent entre les deux rangées externes et les plaques latérales.

L'anus est subcentral, peu visible. La plaque madréporique petite, circulaire, ne dépassant pas le niveau général du disque, est située au milieu du petit rayon de celui-ci; elle est marquée de sillons très-courts, non rayonnants et légèrement rebordée.

Tout le corps est uniformément couvert de fines granulations. Cette espèce se distingue nettement de la *F. milleporella* et la *F. pistoria* par son armature ambulacraire, la plus grande disproportion entre ses plaques marginales et dorsales, le petit nombre de rangées de celles-ci qui constituent la face dorsale des bras.

Localité, Japon.

GENRE ASTERINA (Nardo).

Asterina Lymani (nov. sp.).

Cinq bras reliés entre eux par un arc interbrachial.

$$R = 10 \text{ mm.}, r = 5 \text{ mm.}, R = 2r.$$

Plaques adambulacraires portant chacune quatre piquants serrés l'un contre l'autre. Face ventrale formée de plaques petites, bien distinctes les unes des autres et couvertes chacune d'un bouquet de longs piquants grêles et soyeux. Sur le bord du disque ces bouquets isolés les uns des autres forment une bordure frangée.

La face dorsale est également formée de petites plaques portant de petits bouquets de piquants longs et minces. Chaque bras porte, à droite et à gauche de la ligne médiane dorsale, trois rangées longitudinales de pores tentaculaires isolés.

La plaque madréporique est cachée par les bouquets de piquants.

Asterina pilosa (nov. sp.).

Espèce à six bras, nettement séparés les uns des autres par des angles interbrachiaux arrondis au sommet. Sommet des bras obtus.

$R = 10$ mm., $r = 6$ mm., $R < 2\,r$.

Plaques adambulacraires portant chacune quatre piquants, grêles, presque égaux. Plaques ventrales assez régulièrement disposées en rangées sensiblement normales au bord libre des bras, couverts de piquants, moins allongés, formant à la face ventrale un revêtement très serré. Les plaques ventrales diminuent peu à peu quoique dans de faibles proportions en se rapprochant du bord libre des bras. Chacune des plaques qui forment ce bord porte un bouquet serré de piquants allongés, très minces et comme soyeux. Les pièces dentaires ne sont pas saillantes, et portent chacune un peigne de cinq piquants, ce qui fait dix piquants pour chaque angle buccal.

Les plaques de la face dorsale, qui est légèrement convexe, sont plus petites que celles de la face ventrale, imbriquées, et portent chacune un bouquet hérissé de petits piquants grêles, divergents, inégaux et pointus ; entre ces plaques, dans le voisinage de la ligne médiane des bras, on distingue plusieurs rangées régulières de pores tentaculaires isolés. Ces rangées sont au nombre de six environ pour chaque bras. Immédiatement en dessous du point ou se rejoignent les rangées externes de deux bras voisins, se trouve un orifice plus grand (orifice génital ?) que ceux par lequel sortent les tentacules dorsaux.

La plaque madréporique est petite, convexe, presque entièrement cachée par les piquants dorsaux et située au premier tiers de la distance qui sépare le centre du disque du sommet de l'angle interbrachial voisin.

L'anus est bien visible.

GENRE MARGINASTER (nov. gen.).

Marginaster pectinatus (Ed. P.).

Singulière petite astérie, exactement pentagonale, mais à sommets du pentagone émoussés.

$R = 5$ mm., $r = 4$ mm.

Côtés du corps à peu près rectilignes ; face ventrale plane, face dorsale convexe, mais s'unissant à la face ventrale de manière à former un bord tranchant.

Tentacules ambulacraires sur deux rangs, gouttière ambulacraire, bordée par une rangée de piquants aplatis, tronqués au sommet, isolés, sur chacune des plaques adambulacraires. Une seconde rangée de piquants plus petits et irréguliers se trouve en arrière de la rangée adambulacraire.

Les plaques sont petites, peu distinctes, ainsi que les plaques ambulacraires ventrales, en raison de l'épaisseur de la peau qui les recouvre uniformément sur la surface de chacun des triangles ventraux, compris entre le bord des bras et les gouttières ambulacraires, on observe trois ou quatre piquants courts, mousses, enveloppés par les téguments et irrégulièrement placés. Le bord libre du disque est formé sur la face ventrale par de grandes plaques rectangulaires, dont le grand côté est perpendiculaire au bord du bras, et qui sont séparées les unes des autres par des sillons bien distincts prolongés souvent par d'autres sillons qui obliquent brusquement et se dirigent perpendiculairement à la gouttière ambulacraire la plus voisine. Il existe huit de ces plaques pour chaque côté du corps, et chacune d'elles porte sur son bord libre un peigne de cinq ou six petits piquants aplatis.

Sur la face dorsale le squelette est encore moins apparent que sur la face ventrale. De petits piquants, mousses, isolés, mais assez saillants, sont épars sur cette face. Le corps est également bordé par une rangée de grandes plaques correspondant à celles de la face ventrale et portant comme elle un peigne de piquants, plus courts cependant que ceux de la face ventrale.

La plaque madréporique est petite et située à la moitié de la distance qui sépare le centre du disque du bord libre des bras.

L'anus est visible.

Marginaster echinulatus (Ed. P.).

Petite astérie distincte par ses côtés échancrés de manière à découper cinq bras courts et larges ; le sommet des angles interbrachiaux n'est pas arrondi.

$R = 5$ mm., $r = 3$ mm., $R = 1.6\ r$.

Plaques adambulacraires s'avançant au-dessus de la gouttière ambulacraire et terminées en demi cercle de manière à en festonner les bords, portant sur leur bord libre un demi cercle de quatre ou cinq petits piquants et sur leur surface libre une rangée transversale de deux ou trois piquants divergents. Plaques ventrales distinctes surtout latéralement et formant des rangées séparées par des sillons qui vont obliquement de la gouttière ambulacraire au bord des bras. Chacune d'elles porte deux petits piquants divergents. Pièces dentaires saillantes et séparées par une fente très visible.

Plaques marginales ventrales au nombre de huit pour chaque côté du corps portant chacune sur leur bord libre un peigne de cinq piquants divergents.

Squelette dorsal caché par la peau ; plaques distinctes seulement par les petits piquants qu'elles portent et qui sont irrégulièrement disposés. Plaques marginales peu visibles, bordées par des piquants très courts. Une rangée de pores tentaculaires de chaque côté de la ligne médiane des bras. Plaque terminale des bras, ovale et très grande.

Je n'ai pas pu voir la plaque madréporique.

GENRE RADIASTER (nov. gen.).

Radiaster elegans (nov. sp.).

Grande astérie à cinq bras.

$R = 92$ mm., $r = 26$ mm., $R = 3.5\ r$.

Disque assez aplati, bras ayant à leur base 22 mm. de diamètre environ, reliés entre eux par un arc interbrachial à assez grande courbure, contour nettement limité par une rangée de plaques marginales cachées par les téguments, mais portant chacune à son bord extrême et à son bord interne un bouquet de piquants beaucoup plus gros que les bouquets analogues qui recouvrent toute la surface dorsale et ressemblent un peu aux bouquets analogues des *Solaster*. Ces bouquets marginaux forment ainsi sur tout le contour de l'animal une double rangée assez régulière. Ces bouquets sont un peu comprimés, de sorte que ceux d'une même plaque sont plus rapprochés l'un de l'autre qu'ils ne sont des bouquets des plaques voisines. Les plaques marginales sont au nombre de 39 ou 40 pour chaque bras.

Les bouquets de piquants des plaques dorsales, qui sont également recouverts par des téguments sont formés de piquants grêles, allongés, mobiles, qui peuvent s'écarter les uns des autres ou se rapprocher en fuseaux.

La plaque madréporique assez petite est voisine du bord du disque.

Les plaques adambulacraires portent chacune un faisceau de piquants cylindriques qui sont d'autant plus longs qu'ils sont plus rapprochés du bord de la gouttière ambulacraire; on observe généralement trois de ces piquants sur le bord même de la plaque. À chacune de ces plaques adambulacraires correspond une rangée de plaques ventrales qui se dirigent presque transversalement de la gouttière ambulacraire au bord externe des bras. Bien que ces plaques soient cachées dans le tégument, on les distingue nettement, grâce au bouquet de piquants que porte chacune d'elles. Ces bouquets bien isolés les uns des autres forment sur la face ventrale autant de rangées bien régulières qu'il y a de plaques adambulacraires le nombre de ces rangées est notablement supérieur à celui des pièces marginales; il s'élève à près de 70, de sorte qu'il n'y a aucune correspondance entre le nombre des plaques marginales et celui des plaques adambulacraires. Les piquants qui forment les bouquets ventraux sont plus courts que ceux qui forment les bouquets dorsaux. Les pièces dentaires sont saillantes, couvertes de piquants; leur longueur est de 8 mm. et leur largeur est de 3 mm. Ces pièces arrivent presque au contact et ne laissent pas apercevoir les membranes buccales.

Il n'y a point de pédicellaires.

Les tubes ambulacraires sont bisériés et terminés par une ventouse bien développée.

GENRE CTENASTER (nov. gen.).

Ctenaster spectabilis (nov. sp.).

Six bras grêles mais assez courts se rattachant par des arcs interbrachiaux assez arrondis à un disque large et assez épais. Tubes tentaculaires bisériés pourvus chacun d'une ventouse plane, bien distincte plus large. Toutes les plaques du squelette tant dorsales que ventrales recouvertes par la peau qui n'en laisse pas moins apparaître de nombreux piquants bien acérés.

Bouche située au centre d'un grand disque membraneux qui l'éloigne des pièces dentaires. Celles-ci portent comme les autres plaques adambulacraires un peigne de cinq piquants divergents à pointe obtuse. Les autres plaques adambulacraires portent encore sur la face ventrale, une rangée perpendiculaire à la direction de la gouttière ambulacraire, de quatre ou cinq piquants divergents dorsaux externes plus grêles que les autres et un peu plus longs. Chaque plaque est séparée de ses voisines par un sillon de la peau qui se prolonge d'une façon légèrement sinueuse, parfois même en se bifurquant jusqu'au bord du disque ou des bras. Sur chacune des bandes qui limitent ces sillons on aperçoit un certain nombre de petits piquants épars, assez épais, isolés ou géminés. Le bord dorso-ventral est formé par des plaques dissimulées sous la peau et qui portent chacune une rangée perpendiculaire au plan du disque de cinq ou six piquants, assez gros, obtus et divergents. Il n'y a aucun rapport entre le nombre de ces plaques marginales et le nombre des plaques adambulacraires.

Face dorsale couverte de papilles entremêlées de groupes de petits piquants divergents — une bande lisse vis-à-vis de chaque espace interbrachial.— Plaque madréporique ovale à la moitié du rayon du disque, contigue à un espace interbrachial lisse un peu plus grand que les autres.

$$R = 132 \text{ mm.}, \ r = 48, \ R = 2.07\, r.$$

GENRE PENTAGONASTER (Linck).

Pentagonaster (Tosia) parvus (Ed. P.).

Corps pentagonal, à côtés légèrement concaves. Dans le plus grand échantillon:

$$R = 20 \text{ mm.}, \ r = 14 \text{ mm.}, \ R = \tfrac{3}{2}\, r.$$

Plaques adambulacraires, portant une rangée de piquants suivie de deux rangées de granules; cinq à six piquants sur chacune d'elles. Face ventrale formée de plaques arrondies, assez grandes, entièrement granuleuses, au voisinage des plaques marginales, se dénudant graduellement au centre à mesure qu'on se rapproche de la bouche, et finissant par être bordées d'une simple rangée de granules. Plaques marginales ventrales au nombre de dix pour chaque côté du corps, bordées d'une simple rangée de granules carrées sauf à l'extrémité des bras où les dernières sont trapézoïdes ou triangulaires.

Plaques marginales dorsales au nombre de huit, bordées par une rangée de granules; plaques dorsales arrondies serrées, bordées d'une rangée de granules et portant à leur centre deux ou trois très petits tubercules isolés.

Plaque madréporique, grande, arrondie, située plus près du centre du disque que des plaques marginales.

Le nombre des plaques marginales diminue avec la taille. Il est réduit à six chez un petit échantillon ou $R = 8$ mm.

Pentagonaster grenadensis (Ed. P.).

Belle espèce pentagonale, à côtés légèrement concaves et à sommet des bras plus obtus que dans les espèces précédentes.

$$R = 26 \text{ mm.}, \ r = 17 \text{ mm.}, \ R = 1.4\, r.$$

Piquants adambulacraires arrivant au même niveau que les granules de la surface ventrale avec lesquels ils se confondent. Il en existe cinq ou six sur chaque plaque adambulacraire. Plaques ventrales polygonales uniformément granuleuses et couvertes d'assez gros granules. Plaques marginales ventrales toutes granuleuses. Plaques marginales dorsales au nombre de quatorze, finement granuleuses comme les ventrales ou légèrement dénudées au centre; plaques dorsales polygonales uniformément granuleuses et portant parfois un très petit pédicellaire.

Plaque madréporique au premier quart de la distance du centre au bord du disque.

Pentagonaster ternalis (Ed. P.).

Cinq bras pointus reliés entre eux par un arc interbrachial à long rayon de courbure, pointus.

R = 30 mm., r = 10 mm., R = 3.3 r.

Nombre des plaques marginales ventrales d'environ 50. Ces plaques sont d'abord rectangulaires et allongées dans le sens des rayons du disque, puis elles deviennent presque carrées; elles arrivent au contact des plaques adambulacraires vers le deuxième tiers des bras en comptant à partir de la bouche. Ces plaques sont grossièrement granuleuses ainsi que les plaques ventrales qui sont irrégulièrement polygonales. Plaques adambulacraires presque carrées, couvertes de la même granulation que les plaques ventrales et portant sur le bord de la gouttière ambulacraire une rangée de neuf à dix piquants serrés, prismatiques et comme tronqués au sommet. En outre la plupart de ces plaques portent près de celui de leurs angles avoisinant la gouttière ambulacraire qui est le plus rapprochée de la bouche, un pédicellaire très remarquable puisqu'il est formé de trois ou plus souvent même quatre valves à peu près de même aspect que les granulations qui les avoisinent, mais dont elles se distinguent bien nettement par leur mobilité et la façon dont elles sont rapprochées. On trouve des pédicellaires semblables, quoiqu'un peu plus petits sur un certain nombre des plaques ventrales qui suivent les plaques adambulacraires.

Plaques marginales dorsales en même nombre que les plaques contigues à celles du côté opposé sur toute la longueur des bras, couvertes d'une grossière granulation. Plaques dorsales, saillantes, espacées les unes des autres, polygonales couvertes de granules dont les plus externes légèrement saillantes leur forment une sorte de couronne et portent pour la plupart un ou deux pédicellaires en pinces, à deux valves seulement. Pores tentaculaires isolés à l'angle des plaques, au fond des sillons qui les séparent.

Plaque madréporique polygonale, à sillons rayonnants assez longs, de la grandeur des plaques dorsales voisines, située au premier quart de la distance qui sépare le centre du disque du sommet de l'axe interbrachial. Anus subcentral bien distinct, entouré de petits piquants.

R = 78 mm., r = 32 mm., R = 3.5 r.

Le nombre des plaques marginales paraît le même que dans l'individu précedent.

Pentagonaster subspinosus (nov. sp.).

Disque pentagonal à angles prolongés par cinq bras grêles et pointus, arcs interbrachiaux à grande courbure, arrondis.

R = 65 mm., *r* = 16 mm., R = 4 *r*.

Plaques marginales ventrales plus larges que longues dans l'arc interbrachial, puis devenant plus longues que larges et presque linéaires, au nombre de soixante environ, d'une extrémité à l'autre des deux bras consécutifs, uniformément granuleux, et portant ordinairement un piquant sur leur bord libre dans l'arc interbrachial. À partir de chaque sommet du disque pentagonal, ces plaques sont contigues avec les plaques adambulacraires qui sont elles aussi plus longues que larges et portent même un peigne de sept à dix piquants très fins et sont couverts, dans le reste de leur étendue, de granules coniques assez gros, semblables à ceux qui recouvrent les plaques de la partie ventrale du disque et les plaques marginales. Pièces dentaires petites, a peine distinctes; tubes ambulacraires terminés par une ventouse bien développée.

Plaques marginales dorsales au nombre de 54, plus larges que longues dans l'arc interbrachial, puis devenant graduellement plus longues que larges, finement granuleuses et portant fréquemment au milieu de leur bord libre dans l'arc interbrachial un piquant mousse d'environ 1 mm. de long. Sur les bras proprement dits les plaques de l'un des bords sont contigues à celles du bord opposé.

Plaques du disque granuleuses, sensiblement hexagonales, bien distinctes les unes des autres — un pore tentaculaire vis-à-vis de chaque sommet de l'hexagone. Plaque madréporique à peine plus grande que les autres, mais bien distincte au premier tiers du petit rayon à partir du centre.

Pentagonaster arenatus (nov. sp.).

Cinq bras allongés et pointus; arcs interbrachiaux à assez grande courbure.

R = 57 mm., *r* = 15 mm., R = 4 *r*. E = 100 mm.

Cinquante-deux plaques marginales ventrales, d'abord plus larges que longues puis devenant graduellement plus longues que larges, uniformément granuleuses, totalement inermes, contigües dans la plus grande longeur des bras aux plaques adambulacraires. Une aire triangulaire formée de nombreuses plaques granuleuses, irrégulièrement polygonales et peu distinctes entre l'arc brachial et le sommet de l'angle buccal. Pièces dentaires petites, peu distinctes des plaques voisines. Plaques adambulacraires portant chacune six ou sept petits piquants grêles et assez courts. (La gouttière ambulacraire très serrée ne permet pas de voir les tubes ambulacraires).

Cinquante plaques marginales dorsales semblables aux ventrales, contigues dans toute la longueur des bras. Surface dorsale formée de plaques granuleuses peu distinctes les unes des autres. Plaque madréporique petite, située au premier quart de l'axe du petit rayon à partir du centre.

Pentagonaster Alexandri (nov. sp.).

Bras au nombre de cinq, assez courts, mais bien distincts et émergents des sommets d'un pentagone régulier dont les côtés légèrement concaves réunissent les bras l'un à l'autre.

$R = 9$ mm., $r = 4.5$ mm., $R = 2\ r$.

Largeur des bras à leur base $= 3$ mm. Sur la face ventrale, les plaques interambulacraires portent deux rangées de piquants. Les piquants de la rangée interne au nombre de trois et plus souvent quatre sur chaque plaque sont grêles, allongés, divergents et inclinés sur le sillon ambulacraire; ceux de la rangée externe inclinés au contraire en dehors sont plus gros, plus courts, un peu obtus au sommet et au nombre de trois seulement sur chaque plaque. Les plaques dentaires sont séparées l'une de l'autre par un sillon bien visible.

Les gouttières ambulacraires, et les deux plaques marginales interbrachiales limitent sur la face ventrale une aire triangulaire dans laquelle on ne compte pas plus de six ou sept plaques ventrales portant chacune un groupe de trois à sept granules assez espacées, saillantes, quoiqu'obtus au sommet et figurant presque de petits piquants. Le nombre de plaques marginales ventrales est de douze pour chaque côté du corps, quinze pour chaque bras. Ces plaques vont rapidement en diminuant du sommet de chaque arc interbrachial à l'extrémité des bras; les deux premières de chaque côté du sommet de cet arc sont seules séparées des plaques interambulacraires, les autres sont en contact avec elles. Toutes ces plaques portent des granules espacés qui deviennent plus grands et plus forts en se rapprochant du bord libre de la plaque et simulent alors des piquants.

Les plaques marginales dorsales sont au nombre de dix pour chaque côté (cinq pour chaque bras et une impaire, au sommet du bras) triangulaires et assez grandes. Ces plaques de forme sensiblement carrée vont en diminuant du sommet de l'arc interbrachial à l'extrémité des bras; elles portent de gros granules espacés, disposés comme ceux des plaques correspondantes du bord ventral. Sauf les deux plaques placées de chaque côté du sommet de l'arc interbrachial et une partie de celles qui suivent et qui limitent avec elles l'aire pentagonale du disque, les plaques marginales dorsales d'un côté des bras sont exactement contigües avec celles du côté opposé, de sorte que l'aire paxillaire du disque ne pénètre pas entre elles. Cette dernière se trouve formée de plaques portant des piquants relativement gros et obtus, mais assez longs, de manière à constituer de véritables paxilles.

Cinq de ces plaques plus grandes que les autres forment au cercle du disque un pentagone dans l'intérieur duquel se trouve des paxilles plus petites.

La plaque madréporique, petite, et ne présentant que peu de sillons, est située immédiatement en dehors de ce pentágone, à égale distance du centre du disque et du bord interne des plaques marginales.

Plaques marginales dorsales, au nombre de 24 de chaque côté du corps, sont entourées d'un cercle de granules à leur partie supérieure, granuleuses à leur bord inférieur. Plaques de disque uniformément granuleuses, mais ayant une tendance à se dénuder vers le centre, de sorte que le plus grand nombre présentent simplement une bordure plus ou moins complète de granules. Toutes ces plaques doivent évidemment être uniformément granuleuses sur certains exemplaires.

GENRE GONIODISCUS (Müller & Troschel).

Goniodiscus pedicellaris (nov. sp.).

R = 59 mm., *r* = 18 mm., R = 3 *r*.

Cinq bras réunis entre eux par un arc interbrachial d'assez grande courbure. Plaques marginales ventrales au nombre de 58 d'un sommet à l'autre de deux bras consécutifs, plus larges que longues dans l'arc interbrachial, devenant presque carrées très rapidement, couvertes de petits piquants assez espacés et portant assez fréquemment un pédicellaire valvulaire irrégulièrement placé. Les plaques calcaires qui forment le disque ventral sont entourées d'une couronne de petits piquants semblables à ceux des plaques marginales, au centre des plaques les plus voisines des plaques adambulacraires se trouve enchâssé un pédicellaire à valves plus hautes que larges en forme de cuilleron.

Ce pédicellaire est remplacé par un piquant dans la région moyenne de chacun des secteurs de la face ventrale. Les plaques adambulacraires et marginales sont contigues à partir de la 14^e plaque marginale comptée du sommet de l'arc interbrachial. Chaque plaque adambulacraire porte dans le sillon ambulacraire cinq piquants à peu près de même grandeur; un peu en arrière trois ou quatre piquants beaucoup plus gros et souvent irrégulièrement placées, enfin, sur son bord tourné vers le sommet du bras, un pédicellaire conique à peu près de la grosseur des gros piquants.

Sur la surface dorsale, les plaques marginales sont en même nombre que sur la face ventrale et recouvertes comme elles de petits piquants plus gros sur le bord externe des plaques; elles sont séparées de celles du côté opposé sur plus des deux tiers des bras.

Les plaques dorsales sont légèrement saillantes, arrondies, séparées les unes des autres et laissant voir, dans leur intervalle, les trabécules calcaires rayonnants qui les unissent et limitent les pores tentaculaires. Chacune d'elles est entourée d'une couronne de piquants et porte à son centre de un à trois piquants que remplace parfois un pédicellaire semblable à ceux de la face ventrale. Les plaques interbrachiales ne forment pas de bande distincte. La plaque madréporique est à peu près au premier tiers de la distance qui sépare le centre du disque du sommet de l'angle interbrachial.

GENRE ANTHENOIDES (nov. gen.).

Anthenoides Peircei (Ed. P.).

Cinq bras pointus insensiblement reliés entre eux par un arc interbrachial à grand rayon.

R = 80 mm., *r* = 32 mm., R = 2.5 *r*, *d* = 152 mm.

Plaques marginales ventrales au nombre de 54, allongées dans l'arc interbrachial dans le sens du rayon du disque, puis presque carrées; fortement granuleuses, à granulation plus forte sur leur bord externe, dont l'angle porte souvent un granule plus gros que les autres, figurant une sorte de piquant court et mous, au contact des plaques adambulacraires un peu au-delà de la moitié de la longueur du sillon ambulacraire à partir du centre de la bouche.

Plaques ventrales granuleuses, légèrement bombées; celles qui touchent les plaques adambulacraires les plus voisines de la bouche dans la rangée suivante, portent, en générale, un pédicellaire valvulaire peu saillant et dont l'orientation n'a rien de déterminé. Plaques adambulacraires portant un peigne de sept piquants bien séparés les uns des autres, légèrement divergents et plus grands vers le milieu de la plaque; en arrière de ces piquants une seconde rangée de piquants plus gros et plus courts au nombre de trois par plaque, en arrière desquels se voient les premiers pédicellaires valvulaires séparés les uns des autres par les sillons situés entre les plaques. Pièces dentaires non saillantes. Plaques marginales dorsales au nombre de 50 de chaque côté, presque carrées, recouvertes comme toute la surface du dos d'une peau assez épaisse, finement granuleuses laissant apercevoir les ossicules du squelette qui sont polygoneux comme chez les *Pentagonaster* et bordés de petits pores tentaculaires espacés les uns des autres. Face dorsale légèrement convexe et se laissant déformer par la pression.

Anus visible.

GENRE GONIOPECTEN (nov. gen.).

Goniopecten demonstrans (nov. sp.).

Les bras au nombre de cinq diminuent graduellement de largeur de la base au sommet et sont reliés entre eux par un arc interbrachial d'assez forte courbure.

Les plaques marginales ventrales sont de 92 environ pour chaque côté du corps ce qui fait 46 pour chaque bras.

Ces plaques sont rectangulaires, et leur plus grande longueur est perpendiculaire à l'axe des bras. Les sillons qui les séparent se continuent jusqu'au bord de la gouttière ambulacraire et séparent en même temps les unes des autres les plaques adambulacraires, de sorte que le nombre de ces plaques est précisément le même que celui des plaques marginales ventrales, toutefois elles ne sont pas exactement dans le prolongement de celles-ci; les sillons communs qui les séparent forment à l'extrémité des plaques marginales un angle dont l'ouverture variable est tantôt dirigée vers le sommet des bras, tantôt vers leur base. Les sillons consécutifs peuvent même n'être pas exactement parallèles, et la bande qu'ils limitent s'élargit parfois de la plaque marginale à la plaque adambulacraire qui le termine. Dans la région du disque cette bande est formée par une double rangée de plaques polygonales alternes, généralement allongées dans le sens de la largeur des bras.

Ces doubles rangées se raccourcissent beaucoup sur les bras proprement dits, elles ne sont bientôt plus formées que de deux plaques qui semblent même confondues dès le premier tiers des bras. Tout au moins le tégument membraneux qui recouvre tout le squelette et revêt même les piquants empêche-t-il de distinguer les lignes de sutures qui les séparent des plaques avoisinantes.

Entre les plaques marginales et les plaques adambulacraires on remarque quelques piquants courts, épars, enfouis dans les téguments, peu distincts; des piquants plus petits, réguliers forment sur le bord de chaque série des plaques dans les sillons transversaux qui vont de la gouttière ambulacraire; au bord du bras une fine crénelure régulière, semblable à celle que présentent les *Astropecten* entre leurs plaques ventrales. Parfois le tégument est marqué d'impressions polygonales qui le font paraître comme cailleux.

Chaque plaque ambulacraire s'avance dans le sillon ambulacraire en une forte carène qui s'introduit entre deux tubes ambulacraires consécutifs, de telle sorte que chacun d'eux est comme enchâssé entre deux carènes. Sur le bord de chaque plaque on voit un peigne de huit ou neuf piquants aplatis, assez courts, contigus, et dont les médians sont un peu plus allongés que les autres. Les tubes ambulacraires sont assez gros, coniques, terminés par une ventouse extrêmement petite. Les pièces dentaires forment une saillie ellipsoïdale de 7 mm. de long sur 4 de large, avec une suture très apparente le long de son grand axe. Cette saillie est recouverte de fortes épines et dans l'angle buccal une épine beaucoup plus forte et saillante termine chaque plaque.

Les plaques marginales dorsales sont en même nombre que les plaques marginales ventrales et de forme à peu près semblable; chacune d'elles occupe environ le tiers de la largeur des bras, et est entourée d'une bordure de fins granules; mais ne porte aucune trace de piquants.

La région moyenne des bras et le disque sont formés de très petites plaques polygonales bien distinctes les unes des autres et couvertes de granules qui simulent les paxilles des *Astropecten.*

La plaque madréporique distante de 3 mm. du bord interne de la plaque marginale la plus voisine a environ 6 mm. de diamètre, elle est couverte de fins sillons sinueux et rayonnants. Il existe une apparence d'anus subcentral.

Goniopecten intermedius (nov. sp.).

Cinq bras médiocrement allongés, interbrachiaux arrondis.

$R = 34$ mm., $r = 12$ mm., $R = 3\,r$ environ.

Corps plat, plaques marginales au nombre de 44 à 54, plus larges que longues granuleuses, portant chacune un piquant isolé, obtus, sur le milieu de leur bord libre, contigus sur les bras proprement dits avec les plaques adambulacraires. Espace compris entre le sommet de l'angle buccal et le bord des plaques marginales occupé par des plaques nombreuses irrégulièrement polygonales, granuleuses.

Pièces dentaires, grandes, saillantes sur le disque, bien distinctes l'une de l'autre. Plaques adambulacraires portant chacune sept piquants environ. Tubes ambulacraires terminés par une ventouse très petite presque punctiforme.

Plaques marginales dorsales au nombre de 44, granuleuses, plus larges que longues, portant des piquants au moins dans l'arc interbrachial. Ces piquants sont eux-mêmes semblables à ceux des plaques ventrales correspondantes, mais un peu plus petits. Plaques dorsales de l'un des bords des bras séparées de celles de l'autre bord par une aire paxillaire moins large que les plaques elles-mêmes. Dos couvert de paxilles très analogues à celles des *Astropecten*. Anus bien net. Plaque madréporique à la moitié de l'un des petits rayons à demi cachée par des paxilles plus grandes que celles du reste de la face dorsale, sur le plus grand exemplaire E = 110 mm.; sur le plus petit E = 62 mm.

Goniopecten subtilis (nov. sp.).

Disque pentagonal terminé par cinq bras grêles linéaires.

R = 60 mm., r = 12 mm., R = 5 r.

Soixante-dix plaques marginales ventrales, d'abord plus larges que longues, puis plus longues que larges, granuleuses avec quelques granulures convexes, allongées, presque spiniformes; contiguës sur presque toute la largeur des bras avec les plaques adambulacraires. Celles-ci portent chacune un peigne de cinq ou six piquants plats, obtus, divergents, les médians plus longs que les autres, de sorte que l'ensemble figure un demi cercle. Chaque groupe de piquants très nettement isolé de ses voisins, de sorte que le bord de la gouttière ambulacraire parait festonné. Le reste de la plaque couvert de piquants — plaques ventrales granuleuses.

Pièces dentaires grandes, bien distinctes des autres plaques, un peu saillantes. Tubes ambulacraires à ventouse petite.

Soixante-six plaques marginales dorsales, plus larges que longues d'abord, puis presque carrées, granuleuses; elles sont séparées dans toute l'étendue du bras par une rangée unique de plaques granuleuses plus longues que larges. Toute la surface dorsale formée de plaques hexagonales granuleuses, bien distinctes les unes des autres, dissimulant la plaque madréporique. Anus bien apparent.

GENRE ARCHASTER (Müller & Troschel).

Archaster pulcher (nov. sp.).

Cinq bras: R = 12 mm., r = 4 mm., R = 3 r.

Bras se rejoignant à angles émoussés. Vingt-six plaques marginales ventrales couvertes de granules un peu espacés, en forme de petits piquants, et portant un piquant plus volumineux, mais peu saillant sur leur angle supéro-externe. Aire triangulaire comprise entre les gouttières ambulacraires et les plaques marginales, bien distincte; plaques qui la constituent portant de petits piquants dont le nombre ne dépasse pas six. Des piquants semblables se retrouvent sur les plaques adambulacraires qui portent dans le sillon ambulacraire quatre ou cinq piquants presque égaux, légèrement divergents et formant une rangée régulière. Pièces dentaires assez saillantes terminées chacune vers la bouche par un gros piquant. Ventouse des tubes ambulacraires très petite, vingt-deux plaques marginales dorsales de chaque côté, revêtues de petits piquants espacés; plaque terminale assez volumineuse portant deux piquants comme cela arrive d'ordinaire chez les jeunes *Goniaster.* Plaques dorsales petites surtout vers le centre du disque ne portant guère que six piquants arrondis en forme de granules. Plaque madréporique touchant presque les plaques marginales, distincte seulement par saillie plus grande que celle des plaques voisines et couvertes de piquants semblables à ceux de ces derniers.

Pas d'anus apparent.

Archaster mirabilis (Ed. P.).

Cinq bras grêles, allongés, pointus, se réunissant à angle vif avec leurs voisins.

$R = 87$ mm., $r = 12$ mm., $R > 7\ r$.

Plus de 80 plaques marginales par chaque côté (40 et plus pour chaque bras) chez les grands échantillons. Plaques marginales ventrales contigües avec les bras, à partir de la troisième en comptant du sommet de l'angle interbrachial, à peu près carrées, hérissées de petits piquants parmi lesquels se trouvent deux ou trois piquants beaucoup plus allongés, très pointus et sur le milieu du bord de la plaque un autre piquant très allongé, pointu, pouvant atteindre vers le milieu des bras jusqu'à 8 mm. de longueur.

Les plaques adambulacraires font légèrement saillie dans le sillon ambulacraire, de manière à séparer les tubes ambulacraires les uns des autres; chacune d'elles porte sur son bord interne un peigne de dix piquants, grêles, cylindriques, grandissant rapidement du bord de la plaque en son milieu et divergents.

Les pièces dentaires sont longues de 4 mm. et leur ensemble large de 2 mm.; les deux piquants qu'elles portent sur leur angle buccal sont notablement plus grands que leurs voisins. Les tubes ambulacraires sont terminés par une ventouse d'assez petite taille mais bien distincte.

Les plaques marginales dorsales sont assez petites, presque carrées, granuleuses, et ne portent chacune qu'un long piquant conique semblable à celui des plaques marginales ventrales. Sur le disque un cercle de piquants semblables entoure l'anus. Les paxilles sont petites, espacées, granuleuses. La plaque madréporique beaucoup plus grande qu'elles est très près du sommet de l'angle interbrachial et marquée de sillons rayonnants assez larges. Dans un assez grand nombre d'exemplaires on observe un orifice à la bas des bras, tout près de la ligne médiane de ces parties.

Les individus de grande taille prennent les caractères suivants: Une aire triangulaire formée de plusieurs rangées de plaques entre les plaques marginales ventrales et les plaques dentaires qui sont saillantes sur la face ventrale entre elles une surface ovalaire bien nette. Sur l'aire triangulaire on voit parmi de fins piquants épars une dizaine d'assez gros pédicellaires à deux, trois ou même quatre branches. Pièces dentaires portant chacune onze piquants plus gros à l'angle buccal.

Plaques adambulacraires portant huit piquants grêles, contigus dont les médians sont plus longs. Trente-une plaques marginales ventrales portant chacune de long piquants pointus, outre un revêtement de fines épines.

Ventouse des tubes ambulacraires petites. Plaques marginales dorsales petites au nombre de trente, portant chacune un piquant. Plaques dorsales du disque invisibles. Tout le dos couvert de petits bouquets de trois ou quatre petits piquants qui dissimulent la plaque madréporique. E = 90 mm., R = 45 mm., r = 12 Mm., R = 3.5 r. Angles interbrachiaux arrondis.

Archaster simplex (nov. sp.).

Point de plaques ventrales entre les plaques marginales ventrales et les pièces dentaires. Une plaque marginale impaire dans l'angle des bras supportant les pièces dentaires qui sont arrondies au sommet. Quatorze plaques marginales plus longues que larges, légèrement convexes sur le bord externe, de manière à faire paraître le bord du bras un peu festonné. Ces plaques supportent directement les plaques adambulacraires qui sont plus petites, polygonales, saillantes dans le sillon ambulacraire. Quelques petites épines et une beaucoup plus grande, fine, pointue, se trouvent tout-à-fait sur le bord de chacune des plaques marginales ventrales. Plaques adambulacraires portant sur leur bord quatre ou cinq piquants divergents et un à leur centre. Tubes ambulacraires terminés par une ventouse bien distincte.

Quatorze plaques marginales dorsales plus longues que larges, de forme presque ovale, plus une impaire triangulaire, portant chacune un long piquant pointu au sommet de l'angle interbrachial. Piquant de la plaque impaire double au moins des autres ; une autre épine près de l'anus. Plaques du disque petites, très peu apparentes. Dos présentant de nombreuses petites épines, espacées, sans plaques calcaires apparentes. Plaque madréporique petite, arrondie, à surface irrégulière, vermiculée, presque au contact de la plaque impaire.

E = 35 mm., R = 18 mm., r = 3 mm., R = 3 r, d = 4 mm.

GENRE BLAKIASTER (nov. gen.).

Blakiaster conicus (Ed. P.).

Cinq bras se rejoignant à angle aigu, épais, un peu obtus au sommet, légèrement arrondis en-dessus, plats en-dessous.

R = 27 mm., r = 10 mm., R $<$ 3 r, d = 46 mm.

La physionomie caractéristique de cette espèce tient à l'épaisseur et à la disposition des plaques marginales ainsi qu'un revêtement de piquants des plaques ventrales.

Les plaques marginales ventrales sont au nombre de 15 pour chaque bras, obliques de dehors en dedans et du sommet à la base des bras ; elles ne sont séparées des plaques adambulacraires que par une petite plaque carrée, sauf dans l'angle interbrachial où un petit triangle, formé d'une dizaine de plaques dont l'une occupe le centre du triangle, les sépare de ces autres plaques. Les plaques adambulacraires sont également obliques par rapport au sillon ambulacraire: elles portent dans ce sillon quatre ou cinq piquants allongés et divergents; mais toute la surface est couverte, comme celles des autres plaques ventrales, y compris les marginales d'un revêtement serré de piquants grêles assez allongés, au milieu desquels on distingue sur le bord des plaques marginales quelques piquants plus forts, plus allongés et pointus. Les pièces dentaires sont à peine plus grandes que les plaques adambulacraires voisines, mais saillantes et bien distinctes.

Les tubes ambulacraires sont coniques et terminés en pointe.

Les plaques marginales dorsales sont à peu près verticales dans l'angle interbrachial de sorte qu'on les aperçoit à peine; mais elles deviennent de plus en plus apparentes à mesure qu'on se rapproche du sommet; elles sont couvertes de grossières granulations. La face dorsale est formée de plaques arrondies dont les granules sont plus allongés de manière à figurer une sorte de paxille de 1 mm. environ de diamètre. La plaque madréporique est petite à peine, plus grosse que les paxilles qui l'entourent et les sillons qui la marquent la traversent dans toutes sa longueur, comme chez les *Astropecten*, au lieu d'être rayonnants comme dans la plupart des autres types.

L'anus n'est pas distinct.

GENRE LUIDIA (Forbes).

Luidia barbadensis (nov. sp.).

Six bras, très longs et extrêmement fragiles, toujours très contournés dans les individus conservés dans l'alcool.

$$R = 125 \text{ mm.}, r = 10 \text{ mm.}, R = 12.5\, r.$$

À leur plus grande largeur, les bras ont environ 11 mm. de diamètre. Ils sont aplatis en dessus et conservent dans l'alcool une légère couleur rouge brique.

Les plaques adambulacraires portent dans le sillon ambulacraire un piquant comprimé et légèrement recourbé; puis, immédiatement en dehors, deux autres piquants également comprimés, mais presque droits et disposés un peu obliquement l'un derrière l'autre; derrière eux, deux ou trois petits piquants plus grêles complètent l'armature de la plaque, qui porte en outre un pédicellaire à trois branches. Pièces buccales assez saillantes avec un peigne de cinq ou six piquants dirigés vers la bouche.

Les plaques ventrales sont barbelées de tout petits piquants et portent une rangée médiane de piquants plus gros, coniques, dont les deux derniers grandissent considérablement et forment aux bras la bordure habituelle de piquants.

Sur chaque bras les trois rangées latérales de paxilles de chaque côté sont formées de paxilles plus grandes que celle de la région moyenne; viennent ensuite deux rangées assez régulières de paxilles plus petites, les paxilles médianes sont plus petites encore et irrégulièrement disposées.

La plaque madréporique est cachée par les piquants.

Luidia convexiuscula (Ed. P.).

Six bras — petits pédicellaires à trois branches dans le voisinage de l'angle des bras. — Plaques interambulacraires portant dans le sillon un long piquant comprimé et recourbé et derrière lui un bouquet de piquants plus petits. Plaques ventrales, courtes, couvertes de petits piquants et portant un seul long piquant marginal.

Dos des bras légèrement convexe, à paxilles presque égales, un peu plus petites cependant sur le milieu des bras et sur le disque, portant de petits piquants divergents presque égaux dont les médians, un peu plus gros que les autres, ne se prolongent pas en aiguillon — environ 15 rangées de paxilles.

Plaque madréporique invisible sans préparation.

B = 54 mm., R = 28 mm., r = 5 mm., R = 5.5 r.

GENRE ASTROPECTEN (Linck).

Astropecten alligator (nov. sp.).

Cinq bras, aplatis, terminés en pointe ; angles interbrachiaux non arrondis.

R = 40 mm., r = 9 mm., R = 4.5 r.

Largeur des bras à leur base = 9 mm. Les plaques interambulacraires sont bordées de piquants dont trois divergents occupent le bord du sillon ambulacraire, un ou deux, plus petits sont placés sur les bords latéraux de la plaque et trois sur son bord externe. Quelquefois un piquant s'élève en outre de la partie centrale de la plaque ; les piquants du bord ambulacraire sont d'ailleurs les seuls dont le nombre soit constant. Les plaques ventrales présentent certain nombre d'écailles pointues qui s'amincissent et deviennent plus serrées sur les bords et dans l'intervalle des plaques. Un petit nombre de piquants obtus et aplatis se trouvent parmi les écailles qui deviennent plus longues vers le bord externe de la plaque, formant ainsi une rangée marginale de petits piquants ordinairement au nombre de trois, au-dessus desquels s'insèrent deux piquants plus longs, aplatis et pointus. Les plaques ventrales débordent très sensiblement les plaques marginales dorsales ; celles-ci, au nombre de 30 à chaque bras, peu élevées, presque carrées, sauf dans le voisinage du sommet de l'arc interbrachial où elles sont un peu plus larges que longues. Les granules qui les recouvrent sont assez gros, saillants et non contigus.

Les trois ou quatre premières plaques interbrachiales portent au milieu de leur bord interne un piquant conique, vertical, assez court, celui que supporte la plaque triangulaire qui forme le sommet de l'angle étant un peu plus grand que les autres. Ensuite ce piquant se déplace graduellement en se rapprochant du bord libre des bras sans cependant l'atteindre. À la base des bras, l'aire paxillaire est à peu près égale à quatre fois la largeur des plaques marginales ; les paxilles sont petites et formées de quelques granules centraux entourés d'une couronne de six à huit petits piquants, légèrement renflés au sommet ; elles affectent dans le voisinage du bord des bras une disposition en rangées transversales assez nette. On compte à la base des bras une quinzaine de paxilles d'un bord à l'autre. La plaque madréporique peu apparente, à sillons peu nombreux et non radiés, n'est séparée des plaques marginales que par une ou deux paxilles, tandis qu'on en compte une vingtaine entre elle et le centre légèrement en relief du disque.

Réçu à Cambridge en Mars 1881 ; publié le 25 Juin 1881.

Note. — The list of the stations at which the different species occur will be given in the final report. — A. Ag.

No. 2. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *in the Gulf of Mexico, and in the Caribbean Sea,* 1877–79, *by the United States Coast Survey Steamer "Blake,"* LIEUTENANT-COMMANDER C. D. SIGSBEE, U. S. N., *and* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XV.

Preliminary Report on the Mollusca, by W. H. DALL.

IT has seemed desirable to those directing the publications on these materials, in order to secure proper recognition to those engaged in the sounding and dredging work, that the description of the many new forms contained in their collections be not longer delayed. Later laborers in the same field have already, to some extent, duplicated the materials, and this may be expected to go on in increasing ratio. I have, therefore, endeavored to give recognizable descriptions of those forms which seemed to be new, reserving for further treatment the species on which some doubt existed, or which from their habitat and appearance seemed likely to belong more properly to the fauna of moderate depths. These descriptions are only preliminary to the work in which they shall be properly figured, without which, indeed, species of mollusks can hardly be said to have been wholly published, especially in these days of refinement in specific differentiation.

The materials here described do not include collections obtained by Professor Agassiz and Commander J. R. Bartlett, U. S. N., on the "Blake," in the season of 1878–79, but with very few exceptions form part of the mollusca gathered by the party on the "Blake," in 1877–78, under Professor Agassiz's supervision, while the vessel was commanded by Lieut.-Com. C. D. Sigsbee. The later collections, containing many forms of great beauty, have not yet been administered upon, owing to the limited leisure of the writer, and his absence on official duties.

It can hardly be expected that all the species here described will ultimately prove to be new, but the probability is that most of them are so. In preparing the descriptions, I have been much indebted to the kindness of Mr. R. J. Boog-Watson, in charge of the "Challenger" mollusks, for early copies of his preliminary descriptions, etc., which has enabled me to avoid re-describing species obtained by that expedition, but of which knowledge in many cases has reached but a limited circle of the scientific world. To Dr. J. Gwyn Jeffreys I am also under obligations of a similar nature, and for the most obliging loan of rare and even unique specimens for comparison.

I may add that, so far, the more detailed study of the specimens has done nothing to vitiate the deductions reached in the "General Conclusions" (Bull. M. C. Z., VI. No. 3), but, on the contrary, the views there put forward have received further confirmation.

The difference in richness between the collections of the "Blake" and those of the "Challenger" is truly remarkable, at least so far as the mollusks are concerned; the former containing perhaps three times as many species as the whole three years' voyage of the "Challenger" brought to light.

Cadulus æqualis n. s.

Shell opaque white, polished, without sculpture except a rare line due to growth or some irregularity; very slightly curved with hardly any gibbosity perceptible, such as there is being in the anterior fifth of the shell; anal opening circular, simple, thin-edged, not oblique; anterior opening somewhat oblique, slightly contracted, nearly circular; the shell on the whole tapering regularly toward the posterior end, which is stouter than usual in the genus. Lon. 15.0. Anal diam. 1.0. Oral diam. 2.0. Max. diam. 2.5 mm.

Station 43, 339 fathoms, three specimens.

This species is unlike any of those described from the "Challenger" collections and the others figured by Sars. Its even taper is particularly noticeable.

Cadulus Watsoni n. s.

Shell translucent white, polished, showing faintly the annular lines of growth; slightly curved, with the greater portion of the curve in the anal third tapering rapidly from the oral third to the posterior end; the oral third flattened on the convex side toward the mouth; this portion also tapered laterally in the same direction; oral aperture not perceptibly oblique in the most perfect specimen, slightly so in another; the transverse diameter of the mouth very slightly longer than the vertical diameter. Lon. 13.0; anal diam. 0.6; oral diam. 1.5; max. diam. 2.25; these measurements, when not otherwise stated, being taken from back to front, or from the concave to the convex surface. Max. transverse diam. 2.9 mm.

Off C. San Antonio, 413 fms. Yucatan Strait, 640 fms.

This species is most like *C. colubridens* of Watson (New Zealand, 700 fms.), but has no gibbosity on the concave or (dorsal) side, a less oblique mouth, is more tapered, and more curved up posteriorly.

Cadulus Agassizii n. s.

Shell translucent white with more opaque annulations ; shining, destitute of sculpture excepting nearly imperceptible lines of growth, very slightly curved, the dorsum being nearly straight except at the posterior fourth, oral end very slightly tapered, not flattened; posterior part gently tapering from the anterior third ; anal end rather stout, opening simple, circular; oral end thin, mouth forming an angle of 45° with the axis, simple, quite circular ; the tube with no pronounced gibbosity. Lon. 9.0. Max. lat. 2.0. Oral diam. 1.5. Anal diam. 0.75. Max. diam. 2.0 mm.

Station 5, 229 fms.

This species resembles *C. sauridens* Watson, but is three times the size, wants the gibbosity, and has a straighter back. It differs from *C. gracilis* Jeffreys in size and in wanting the compression, so far as can be decided in the absence of a specimen or figure of Jeffreys's species. The proportions are different from those of *V. Pandionis* V. and S., of which the mouth is described as elliptical.

Cadulus lunulus n. s.

Shell translucent white, smooth, destitute of sculpture; dorsum nearly straight, slightly inflated near the middle ; oral end contracted, not flattened, and more slender at the mouth than the posterior end ; the shell largest in the middle, and tapering nearly equally to both ends, apertures simple, circular, the oral one oblique and quite contracted in proportion to the rather stout form of the shell, which, but for the curve of the convex side and extreme ends, would be nearly evenly fusiform ; there is no gibbosity, and, though the anal aperture is the larger, it seems unbroken. Lon. 6.0. Oral diam. 0.75. Anal diam. 0.87. Max. diam. 1.5 mm.

Station 2, 805 fms.

Most like *C. simillimus* Watson, from which it differs in its more even half-moon shape, and proportions.

Cadulus cucurbitus n. s.

This little shell is perhaps best described by saying that in form it is about midway between *C. obesus* Watson and *C. tumidosus* Jeffreys, being larger than the former and more evenly tapered from the middle than either. It wants the ledge within the aperture at both ends, is polished, translucent, and without perceptible sculpture ; neither of the apertures appears to be oblique ; both are circular. Lon. 4.0. Max. diam. 1.25. Oral diam. 0.62. Anal diam. 0.37 mm.

Station 19, 310 fms.

It is really somewhat difficult to decide which is the anterior opening in this species, unless the size be considered a criterion.

C. sauridens Watson.

St. Thomas, Challenger Exp., 390 fms. Blake Exp., Station 19, 310 fms. ; off Cape San Antonio, 1,002 fms. Barbados, Hassler Exp., 100 fms.

C. obesus Watson.

St. Thomas, Challenger Exp., 390 fms. Blake Exp., Station 20, 220 fms.

Siphonodentalium quadridentatum n. s.

This species is best described by comparing it with *S. tetraschistum* Watson, to which it is nearly allied. The present form, which may prove eventually to be a large race of Watson's species, seems to differ from it in its proportionately greater stoutness and actually larger size, in the want of any sculpture on its polished surface, and in the proportionally smaller and narrower slits at the anal end of the tube. The dimensions of *quadridentatum* are : — Lon. 10.0. Max. diam. 1.3. Oral diam. 0.80. Anal diam. 0.4 mm. The same in Mr. Watson's species are 7.7, 0.81, 0.75, and 0.4 mm. respectively. His specimen came from Fernando Noronha, 7-25 fms. ; ours is from Pourtalès's dredgings on the west coast of Florida, in 30 fms.

In other respects than those mentioned, Watson's description and figure agree almost exactly with our specimen.

DENTALIUM.

A. — *Species with cylindrical tube.*

D. perlongum Dall.

Bull. Mus. Comp. Zoöl., V. No. 6, p. 61 (name only). 1878.

Shell solid, opaque white, shining, without sculpture except delicate irregularities due to incremental lines ; oral aperture simple, nearly circular, its plane quite or nearly at right angles to the axis ; anal aperture with a shallow notch (in adult specimens) on the convex side ; tube very slightly curved. Lon. 50.0 to 80.0. Anal diam. 0.5 to 0.7. Oral diam. 3.5 mm.

Station 41, 860 fms. Station 46, 888 fms. Yucatan Strait, 640 fms. Station 33, Lat. 24° 1′, Lon. 88° 58′ W., 1,568 fms.

This superb species may be compared with *D. acutissimum* Watson, but is proportionally more slender, wants the faint longitudinal striæ, and is without an anal notch on the concave side.

D. agile M. Sars.

Antalis agilis G. O. Sars, Moll. Reg. Arct. Norv., p. 102, tab. 20, fig. 9. 1878.

Station 32, 804 fms. Station 33, 1,568 fms.

I can find no characters to separate these specimens from Sars's species, except the absence of the (inconstant) notch at the anal extremity, although they appear to be perfect.

D. antillarum D'Orb.

Sagra, Moll. Cub., Pl. XXV. figs. 10–13.

Station 20, 220 fms.; Barbados, 100 fms.; Yucatan Strait, 640 fms.; Station 44, 539 fms.; Station 19, 310 fms.; Station 43, 339 fms.; Station 33, 1,568 fms.; off C. San Antonio, 1,002 fms.

D. disparile D'Orb.

Loc. cit., figs. 14–17.

Station 41, 860 fms.; Yucatan Strait, 640 fms.; Barbados, 100 fms.

D. ceras Watson.

Station 33, 1,568 fms.

This specimen measures 50.0 mm. in length. Watson's came from the mid-Pacific, east of Japan, in 2,050 fms., and from the Atlantic, west of Valparaiso, in 2,160 fms.

D. sericatum n. s.

Shell small, very thin, acute, slightly curved, rather rapidly enlarging; covered with fine, sharp, close set longitudinal grooves with narrower threadlike interspaces separating them to the number of thirty-six on the middle and about fifty at the oral end of the shell; plane of the oral aperture at right angles to the axis, both apertures circular, simple; color translucent white, with opaque white wavy lines (like those on the silk goods known as *moire antique*) encircling the shell with zigzags whose successive irregular bands (0.8 mm. apart in the middle of the shell) are sub-parallel with one another, and gradually become more slender and further apart toward the ends. In a specimen 13.0 mm. long there are about fifteen of these bands, each band with about 10 or 12 angles. Lon. 13.0. Anal diam. 0.37. Oral diam. 1.2 mm.

Yucatan Strait, 640 fms.

The sculpture of this species recalls that of *D. capillosum* Jeffreys, which is a much larger species, less suddenly attenuated, and, so far as described, wanting in the remarkable color-pattern of *D. sericatum.*

D. ceratum n. s.

Shell of waxen hue becoming whiter toward the mouth, aculeate, slightly curved, rather stout, and of glassy texture; at the anal end septangular, the angles passing into riblets at the beginning of the middle third, then becoming gradually much more numerous, finer, fainter, and lastly absent or evanescent on the oral third. Surface shining, apertures simple, circular. Lon. 30.0. Anal diam. 0.5. Oral diam. 2.0 mm.

West Florida, Pourtalès, 50 fms. Station 2, 805 fms.

This species has about the curve and proportions of *D. circumcinctum* Watson, but is much smaller, has a wholly different sculpture and no anal notch.

B. — *Species with tube laterally compressed.*

D. Sigsbeanum n. s.

This may be best described by comparing it with its nearest ally, *D. didymum* Watson (St. Thomas, W. I.), than which it is more slender, more attenuated, more arched, and the compression results in an evenly elliptical section, instead of a subtriangular one, as in his species. It is translucent whitish, less brilliant than the last-described species, and apparently, from the look of the eroded tips, is notched at the anal end, but this is not certain. Lon. 20.0. Anal diam. 0.3. Major oral diam. 2.0. Minor do. 1.1 mm.

Yucatan Strait, 640 fms.

C. — *Species with tube transversely compressed.*

D. compressum Watson.

Station 43, 339 fms.; off C. San Antonio, 413 fms. (Culebra, St. Thomas, 390 fms. — Challenger.) This turns out not to be a *Siphonodentalium,* after all.

D. ophiodon n. s.

About the same length as the last species, more slender, more acute, more translucent, more curved, and without the evanescent indications of longitudinal striation; the compression results in less tendency to angulation, and there is an evident tendency, in adult specimens, for the diameter at the mouth to be somewhat less than at a short distance behind it, — a very marked distinction as between the two. The shell is quite translucent, and very thin; there is very little variation between the specimens. Lon. 12.5. Anal diam. 0.27. Major oral diam. 1.3. Minor do. 1.1 mm.

Station 19, 310 fms. ; Station 20, 220 fms. ; Station 21, 287 fms.

The flattening is most prominent a little way behind the mouth in the adult, and is best seen in an adolescent specimen.

Siliquaria modesta n. s.

Shell white, small, delicate, irregularly coiled, unattached, surface without sculpture except that formed by the rounded incremental lines, which have somewhat the appearance of floss silk when wound on a spool. Apical part a simple cone, which bears marks of the slit as far as can be seen almost from the first ; the apical and terminal portions usually more loosely coiled than the middle part ; the slit near the mouth is open continuously, with an undulated margin ; further back the prominent parts of the undulations approach each other, finally joining, forming ovate holes, which, lastly, are entirely filled up in the older third of the shell. The coils rarely exceed 25.0 mm. in length, and gradually enlarge ; the diameter of the mouth is 3.0 mm. or less ; of the widest part of the slit, about 0.5 mm. Found at all depths from 80 to 800 fathoms, but not in less than 80 fathoms. The specimen from which the description was taken lived in 220 fathoms (Station 20). The shell is so very fragile that only living ones came up in even tolerable condition ; the dead ones can hardly bear touching. It is evidently suited only to a soft and quiet bottom.

Bivonia exserta n. s.

Shell white, uncoiled or only curved ; short, stout, thick, attached by its tip only, and rising upward and forward from this support. Interior of tube circular in section, smooth ; exterior having five longitudinal ribs, or keels, and otherwise deeply and strongly annulated, looking like a pile of round-edged coins or biscuit, one upon another. Lon. 11.0 mm. Diam. 2 mm. Internal diam. 1.0 mm. Length of attached portion, 3 mm.

This has a remarkable sculpture, and is only provisionally referred to *Bivonia*, as the operculum is unknown. Found with the last.

Pedicularia albida n. s.

Shell in the embryonic state (as seen imbedded in young specimens) apparently having somewhat the shape of an immature *Marginella*, of a deep pink or salmon color, the visible surface of the nuclear whorl polished, smooth, the second with a sharp keel, the succeeding ones granulated or reticulated, but generally so immersed in the adult shell as to be indistinguishable. The whorls of the adolescent shell white, marked with numerous even, fine revolving threads, separated by equivalent grooves, both becoming coarser with growth and terminating in denticulations on the margin and the distinct columella ; these threads are prettily reticulated by the lines of growth. In the adult, the outer lip and the outer margin of the columellar callus (which is then irregularly striated) are produced in a more or less irregular manner, become confluent, and assume the shape of the coral upon which the animal lives. Diam. of embryonic shell, 0.37 mm; of adolescent, 2.5; of adult, 5.0 mm. Lon. of adult, from 3.0 to 9.0 mm.

Barbados, Hassler Exp., 100 fms. Off Havana, Sigsbee, 450 fms. Yucatan Strait, 640 fms.

This seems sufficiently different from any species noticed by me.

Margarita ægleis WATSON.

Linn. Soc. Journ., XIV., 1879, p. 704; St. Thomas, W. I., 390 fms.
M. lamellosa Verrill and Smith, Am. Journ. Sci., Nov. 1880, p. 397.

This beautiful species, like most of the genus, is exceedingly variable, the umbilicus varying from very wide to comparatively narrow, the shell depressed or conical; the number of nodulated ribs or simple carinæ, the thickening or absence of it on the pillar, and the number of whorls, differing according to age and individual. I am not at all sure that others of Watson's species should not be combined with this; but, in the absence of specimens for comparison, I hesitate to do more than suggest a careful inspection. The number examined shows every transition.

Station 2, 805 fms.; Yucatan Strait, 640 fms.; Station 21, 287 fms.; Station 46, 888 fms.; off Cape San Antonio, 640 fms.; Station 41, 860 fms.; Station 19, 310 fms.

Margarita asperrima n. s.

Shell conical, yellowish white, turreted, higher than wide; whorls five to seven, the last forming half the height of the shell; base rounded, umbilicus small, partly covered by the reflexed lip, transversely striate, with one longitudinal thread close to the bounding nodulated strong carinal rib; upper whorls with two strong longitudinal ribs, the lower of which forms the carina of the last whorl; near the beginning of the latter a single less conspicuous thread is intercalated between these two; the carina is above the middle of the last whorl, and between it and the bounding rib of the umbilicus are four strong, simple revolving threads, not nodulated, between which, near the mouth, intercalary, weaker threads begin to appear. Suture distinct, compact, not channelled, except by projection of the ribs above and below it which give the shell a turreted appearance. Lip thin or slightly thickened, denticulated on the edge by the rib-ends; pillar little thickened, its base apparently toothed by the ends of the umbilical threads (these denticulations are probably missing in the perfect adult); mouth slightly oblique, not produced below; transverse sculpture consisting of threads following the lines of growth, rising into lamellæ between the ribs, and in passing over them (except the basal ones) forming squarish projections, cutting the ribs obliquely. Nucleus smooth, polished, the remainder dull white, with no visible nacre. Alt. 7.5. Lat. of base, 6.0. Height of aperture, 3.0 mm.

Station 12, 177 fms.; Barbados, 100 fms. ; Station 20, 220 fms.

This little shell has much the form of *Trochus transenna* W. The regularity of its asperities has a very pleasing effect, and it seems quite different from any described species.

Margarita scabriuscula n. s.

Shell white, conical, compact, very thin, with a silky lustre ; whorls, five to six, suture not channelled ; nucleus bulbous, polished, smooth ; next whorl and a half having a sculpture of slightly raised ribs like a minute *Scalaria;* on the following whorls the upper surface decorated with two carinæ, sculptured with closely set, angular, buttressed projections, like those figured by Watson on the carinæ of *Trochus clavatus* (Pl. V. fig. 8), but the buttresses are not continuous over the whorl, so as to form transverse ribs, and the second carina is within the periphery of the last whorl, which is bordered by a sharp, angular carina, without nodules or projections ; two similar, but lightly nodulated, intervene on the somewhat rounded base between the last and the nodulated boundary of the umbilical chink, which is nearly filled by the reflected pillar ; the lines of growth radiate in a wavy manner from the umbilicus over the whorl, and constitute the remaining sculpture ; there are no longitudinal striæ of any kind, or any ribs except those described ; the aperture is nearly rectangular, a little wider than high ; the sides of the spire are rather a little inflated than simply conical. Alt. 4.75. Lat. of base, 4.0. Lat. of aperture, 1.62 ; alt. 1.12 mm.

Station 44, 539 fms.

This has the characteristic aspect of an abyssal shell.

Margarita lissocona n. s.

This species belongs to the same group as the last three mentioned species, but is nearest to the last. The shell is more simply conical, consisting of six and a half whorls, which glisten with that peculiar spun-glass or flossy lustre noticeable in so many abyssal species ; the nuclear whorls as in the last ; then the sculpture consists of two lines closely appressed to the sutures, less prominent and less conspicuously provided with the angular projections than in the last species. Between the upper and lower lines the surface of the whorl is smooth, except for lines of growth, shining as above described, and seems even a little concave. The nodules on the upper carina of one whorl fit into the spaces between the nodules on the lower carina of the preceding whorl, and thus alternate along the line of the suture and give it a wavy character. The carina on the last whorl is seen to be formed by two threads, which constitute the periphery, with fainter angularities than the others. The base is somewhat inflated, with two sharp, smooth threads between the periphery and the nodulate boundary of the small funnel-shaped umbilicus. The lines of growth are much as in the last species, the umbilicus is not infringed upon by any reflection of the pillar lip, and the aperture is about as wide as high, and less distinctly rectangular. Alt. 5.5. Lat. of base, 4.5. Lat. of aperture, 2.0 mm.

Station 47, 331 fms.

This little species recalls the last in many features, but the differences in sculpture and umbilicus are so great that it seems inadvisable to unite them without a connecting series.

Margarita filogyra n. s.

Shell white, or brownish white, but little nacreous, except when decorticated ; suture appressed, not conspicuous ; whorls six, the first two and a half smooth and glassy, the others, on the upper surface, supplied with four carinæ, extending from the periphery half-way in toward the suture ; the space between the inner carina and the suture sculptured with fine even radiating ridges, striated by the lines of growth, underneath which are a few inconspicuous longitudinal threads ; on passing over the inner carina these ridges become about three times as numerous, and so continue over the whorl, the base being supplied with about eighteen smooth, fine, even, close set revolving lines ; the radiating lines or fine ridges are almost obscured until they pass into the umbilicus, where they appear as striations on its walls. The umbilical rib is not nodulated ; the sides of the umbilicus are so straight that they look concave above the rib, and the perforation is visible to the apex, though not wide or funnel-shaped. The base of the shell is full and rounded, the pillar lip emarginated, and the aperture almost round ; there is no reflection or callus, except that in adult shells the outer lip is a little thickened, while in young ones it is slightly emarginated by the ends of the carinæ. Alt. 6.75. Lat. of base, 8.0 ; of aperture, 4.0 ; of umbilicus, 1.5 mm.

Off Cuba, Pourtalès, 200 fms. Station 20, 220 fms. Yucatan Strait, 640 fms.

This recalls the *M. groenlandica* in some respects.

Margarita (Turcicula) imperialis n. s.

Shell with five (?) whorls, globosely conical, white, extremely thin ; umbilicus reduced to a mere chink under the thin callus of the upper part of the pillar lip. Mouth rounded rectangular, pillar somewhat concave, margins all thin ; base flattened convex, with seven revolving ribs, the outermost of which is just within the periphery, crossed by radiating lines of growth, regular and very fine, but raised into low, very sharp lamellæ, which pass over the periphery on to the upper surface of the whorl ; the last is provided with two strong revolving ribs, one of which forms the periphery, while the other lies a little less than half-way from the first toward the suture ; two indistinct threads run in the vicinity of the suture ; on the revolving ribs above mentioned there are regularly disposed sharp rough tubercles (seventeen on the last whorl), most prominent on the middle carina ; the above-mentioned lamellæ are arranged with a regular irregularity (which gives a shagreened appearance to the surface) between the carinæ, and are still coarser and more elevated over the threads near the suture, forming there a double row of scales partly obscuring the suture, which is nevertheless rather deep. Alt. of last whorl, 10.0. Lat. 13.0. Alt. of aperture, 5.5. Lat. of same, 6.25 mm.

Off Cuba, Pourtalès, in 200 fms.

The single specimen taken, though destitute of the apical whorls, seemed too remarkable to leave undescribed. It has a general resemblance to some of A. Adams' species of *Turcica* from Eastern seas, but has a peculiar and remarkable sculpture, and wants the teeth on the pillar.

Margarita iris n. s.

Shell thin, brilliantly nacreous, inflated, depressed-conical, five-whorled ; spire obtuse ; nucleus polished, smooth, very minute ; remainder of shell sculptured with fine revolving lines, subequal, about as wide as the interspaces, about eighteen at the beginning of the last whorl ; these are crossed by slight plications, beginning near the suture, becoming nodulous on a single prominent thread a little way from the suture (which is thus made to appear somewhat channelled), becoming faint about the middle of the upper side of the whorl, and entirely disappearing before reaching the periphery ; the revolving lines are fainter on the rounded base ; the umbilicus is wide and funnel-shaped, bordered by a strong keel with about twenty-five rounded nodules, the inner walls of the umbilicus with strong revolving lines delicately reticulated by the lines of growth. The whorls are rounded, with no carina at the periphery ; the pillar thin, arched, not reflected ; the aperture nearly round, but angulated above by the sutural thread, and below by the umbilical keel ; edges simple, not thickened ; operculum thin, corneous, multispiral ; shell nacreous, with delicate suffused splashes of brown. Alt. 5.0. Maj. diam. 5.5. Diam. of aperture, 2.0 ; of umbilicus, 2.75 mm.

Sand Key, 119 fms.

Margarita maculata n. s.

Shell in general form and sculpture much resembling the last, but without the nacreous coloring, stouter and coarser in every respect. Whorls five, the revolving threads on the upper side of the whorls only seven in number (on the last whorl), of which the inner two are crenulated by the radiating plications which otherwise are visible only as radiating threads in the interspaces, the base rounded with nine flattened revolving ribs separated only by incised lines and crossed by delicate lines of growth. The umbilicus much smaller than in the last, bordered by two nodulous ribs with a remarkably deep groove between them ; aperture as in the last, but not so distinctly angulated ; shell variously painted with brown on a yellowish white ground ; one specimen has five distinct brown patches on the upper side of the last whorl, another has more numerous radiating brown streaks ; the base is whitish, and in adults there is a thickening of the inside of the aperture all round, but least on the pillar. Alt. 4.5. Maj. diam. 5.0. Diam. of aperture, 2.25; of umbilicus, 1.0 mm.

Station 2, 805 fms.

Margarita lubrica n. s.

Shell small, conical, white, shining, with a slight nacreous hue; whorls five full and rounded; suture distinct; from about the beginning of the third whorl a row of round nodules extends along the upper line of the whorls just below the suture, about twenty-five on the last whorl and more faintly defined near the aperture; base perforated by a small umbilicus bounded by a thickened raised line, within which are about twelve plications extending up into the umbilicus; outside of this line a few radiating impressed lines extend toward the outer part of the whorl; faint lines of growth are here and there visible on the polished surface; aperture nearly circular, thin-edged, simple; the pillar slightly extended on the umbilical side, not thickened. Alt. 4.0. Major diam. 3.25. Diam. of aperture, 1.5; of umbilicus, 0.5 mm.

Station 2, 805 fms.

This shell may possibly not be a *Margarita*, but there seems no other place available for it. The minute nucleus and regular form preclude the idea of its being the fry of something larger.

Margarita (?) euspira n. s.

Shell conical, shining, pearly white, elevated, with a rather obtuse apex; five-whorled, the nucleus translucent, white, and with a sculpture of strong revolving threads, of which that nearest to the suture is most pronounced, and continues, at first sharp, then with slight waves, then with oblique waves like the "lay" of a stranded rope, and on the last whorl as a succession of well-elevated, pinched-up points forming a band next the suture; the others disappear on the third whorl, and for the rest the shell is only marked by faint lines of growth here and there a little more pronounced in the vicinity of the umbilical callus; periphery with a tendency to carination, base rounded; aperture oblique, rounded, margin sharp, simple, pillar stout, thick, inseparable from a thick white callus which forms a lump over the umbilical pit; end of pillar (broken in specimens seen so far) apparently forming a sort of lump or thickened angle. Suture distinct throughout. Alt. 5.75. Major diam. 6.0. Diam. of aperture, 3.0 mm. Defl. somewhat less than 90°.

Station 2, 805 fms.

Perhaps not a *Margarita*, but with no sufficient characters to justify its being separated in the absence of soft parts.

Calliostoma circumcinctum n. s.

Shell solid, strong, white, elevated, conical, seven-whorled; nucleus polished, small, delicately reticulate; other whorls with two sharp, much produced, thin keels a little recurved at their edges, and crossed only by most delicate lines of growth ; base flattened, ornamented with nine angular ribs, the outermost produced somewhat ; umbilicus none, aperture subrectangular, notched by the keels ; pillar simple, somewhat projecting at its anterior end, not callous ; suture appressed, distinct, not channelled. Alt. 8.0. Basal diam. 6.0. Diam. of aperture, 3.0 mm.

Yucatan Strait, 640 fms. ; Station 2, 805 fms.

This somewhat resembles a *Calliostoma annulatum* in miniature, with the characters exaggerated and minus the coloration.

Calliostoma tiara Watson sp.

Trochus (*Ziziphinus*) *tiara* Watson, *loc. cit.*, p. 696 (390–1,075 fms.).

Off Havana, Sigsbee, 450 fms. ; Station 44, 539 fms. ; Station 20, 220 fms. (St. Thomas and Bermuda, Watson, Challenger Exp.)

The number of these which I have to compare is smaller than of *Margarita ægleis*, but the variations are as numerous as the individuals, and there are specimens with an impervious base, while others indicate a chink in the umbilical region. The sculpture is tolerably constant, and the elevated shape much more so than in the Margaritas.

Calliostoma Bairdii Verrill and Smith.

C. Bairdii Verrill and Smith, Am. Journ. Sci., *loc. cit.*, p. 396, Nov. 1880.
C. Psyche Dall (not described), Bull. M. C. Zoöl., V., p. 61, July, 1878.

This lovely species was first found by Pourtalès in 100 to 200 fms. along the Florida reefs ; it seems to vary from 80 to 350 fms. in its habitat. The original specimens were burned at Chicago ; others were subsequently collected, and more lately it has been found by the United States Fish Commission in deep water off Newport, R. I. It strongly recalls some of the European forms.

Calliostoma roseolum n. s.

Shell acute conical, eight-whorled ; the first five whorls flattened, the last three somewhat rounded ; periphery of last whorl gently rounded to meet the rather flattened base ; umbilicus none ; pillar short, straight, ending in a slight knob inside the margin of the aperture, which is thin, crenulated by the sculpture, nacreous, obliquely set and subrectangular in form ; sutures appressed, hardly visible except in the last three whorls ; color delicate rosy, nucleus smooth and white ; the base with about twelve equal revolving ribs consisting of successive rounded nodules, of even size, somewhat like strings of beads ; the first, third, and fifth ribs, counting from the pillar, show every third bead crimson, the others white ; the other basal ribs have the rosy color of the shell, but in the seventh, ninth, and eleventh, each alternate or each third bead has a deeper crimson tint, though this is hardly visible without a glass. On the upper surface of the whorls are (eight in the last whorl) similar beaded ribs, several of which have rosy beads alternating with crimson ones ; the general rosy hue is clouded darker and lighter alternately, but in an indefinite way. The sculpture of the whole shell is very uniform. Alt. 9.5. Basal diam. 7.0. Diam. of aperture, 3.5 mm.

Station 11, 37 fms. Lat. 23° 43′ N., Long. 83° 25′ W., near Havana.

This is one of the early finds of Pourtalès, lost at Chicago, afterward refound, and has been known to me for a good many years. It recalls *C. macandræ* from Panama in general form, and is one of a group of small species, apparently hitherto undescribed, which have a considerable general resemblance to one another, and to some West American forms.

Calliostoma apicinum n. s.

Shell conical, of six whorls, elevated, thin, rather solid ; whorls and base flattened, the sutures hardly visible, the last whorl subangulated, but not carinated, on the periphery. Nucleus prominent, bubble-shaped, shining, opaque white ; second whorl deep rose-pink, with three longitudinal beaded ribs ; rest of shell yellowish white, with indistinct clouds of brown transversely disposed on the upper whorls ; the lower rib on the second, third, and part of the fourth whorls with somewhat larger beads than the rest, crowning the suture ; the upper side of the last whorl with about nine revolving beaded ribs with a slight tendency to run in pairs, beginning at the periphery ; base with eleven somewhat flattened ribs, only the two next the pillar beaded, the others crossed by evident lines of growth, radiating in a wavy manner ; umbilicus a hardly visible puncture ; pillar grooved, hardly thickened, aperture not very oblique, crenulated (especially below) by the ends of the ribs, subrectangular. Alt. 7.5. Basal diam. 7.0 ; of aperture, 2.0 ; width of do. 4.0 mm.

Barbados, 100 fms. Off Havana, Sigsbee, 175 fms.

Calliostoma sapidum n. s.

This species bears a strong superficial resemblance to the last, and is best described by a differential diagnosis ; it is entirely white, not colored ; it has seven whorls in a shell of the same size as an *apicinum* with six ; the sutures are slightly channelled, and therefore distinctly visible ; there are four instead of nine beaded ribs on the upper side of the last whorl, and the beads are coarser, the interspaces wide enough to show the lines of growth crossing them ; the nodules on the peripheral rib in this whorl are undulations rather than beads, and sufficiently large to give a crenulated appearance to the border of the shell when viewed from below ; there are eight revolving ribs on the base crossed by fine ridges following the lines of growth ; there is no umbilicus or callus ; the pillar is not grooved or thickened ; the aperture is more oblique and proportionately less wide. Alt. 5.0. Basal diam. 4.12. Alt. of aperture, 1.5. Width of do. 2.0 mm.

Station 2, 805 fms.

Calliostoma Yucatecanum n. s.

Shell belonging to the group of *C. Palmeri* Dall, *C. eximium* Rve., and *C. lima* of the western coast of America. Shell depressed conic with a rather acute apex and six whorls ; nucleus white, delicately sculptured ; remainder of shell whitish with faint streaks of brown transverse to the whorls, arranged so as to present the appearance of seven brownish streaks radiating from the apex ; other dots and streaks of brown irregularly distributed ; upper side of whorls with one smooth revolving keel nearly midway between the sutures, but a little nearer the periphery ; this gives the whorls a somewhat tabulated aspect ; above this on the last whorl are four smaller more or less beaded or crenulated keels, below it are two without nodosities, reaching the gently rounded periphery ; between these are intercalary threads or grooves ; base supplied with nine rounded revolving ribs, those nearer the umbilicus with a tendency to beading ; interspaces about as wide as the ribs, which are crossed by slight elevations due to lines of growth ; umbilicus perforate, bordered by a strong white rib, inner walls smooth or transversely striate ; pillar emarginate, twisted, not thickened, ending in a rounded lump above the basal margin of the aperture ; the latter oblique, subrectangular, nacreous, sharp-edged, crenulated by the ribs. Operculum as usual in the genus. Alt. 7.0. Basal diam. 7.0. Diam. of aperture, 4.0 ; of umbilicus, 1.0 mm.

Yucatan Strait, 640 fms.

Calliostoma echinatum n. s.

Shell small, white, acute-conical, in general resembling *C. sapidum*, but less stout and solid and with wholly different sculpture ; whorls six, somewhat appressed toward the apex ; nucleus smooth, semi-transparent, inflated, shining, remainder of shell opaque white with the following sculpture ; on the upper whorls, four revolving ribs with smaller inconspicuous ones between them, crossed by faint plications (more evident on the smaller whorls), producing nodosities which, on the four principal ribs, and especially on the third one, counting from the suture toward the base, rise to acutely pointed projections separated by an incurved scallop of about twice the width of the projections ; toward the aperture the ribs and nodosities become more equal in size ; base flattened, impervious, sculptured with some fifteen close set flattened revolving ribs crossed by impressed radiating lines of growth ; aperture nearly rectangular ; pillar straight, stout, not projecting, without a callus ; margin thin, a little crenulated by the sculpture. Alt. 5.25. Basal diam. 4.75. Diam. of aperture, 2.0. Alt. of same, 1.75 mm.

Sigsbee, off Havana, 80 fms.

Seguenzia formosa JEFFREYS.

Rep. on Valorous Cruise, Proc. Roy. Soc., 1876, p. 200.

Station 16, 292 fms. Station 20, 220 fms.

Seguenzia ionica Watson.

Watson, *loc. cit.*, p. 589.

Station 33, 1,568 fms. Station 41, 860 fms.

Seguenzia delicatula n. s.

Shell somewhat resembling *S. carinata* Jeffreys, but with the sides of the cone rather concave than convex, an acute apex, and quite differently sculptured. Whorls seven, the nucleus prominent, rounded, transparent ; the next two whorls irregularly reticulately sculptured with the transverse sculpture following the lines of growth ; the remainder having fine revolving liræ entirely covering the whorl above and below ; a raised band just above the suture or basal margin, across which pass squarish bands half the width of their interspaces, composed each of several threads following the lines of growth, lost on the middle upper surface of the whorls and reappearing as flexuous plications below the sutures. Base plano-convex, crossed by lines of growth which appear as slight plications near the umbilicus and as nodules (18–20) on the strong umbilical rib. Otherwise much as in *S. carinata.* Alt. 5.0. Basal diam. 6.0. Umbilical diam. 1.0 mm.

Station 2, 805 fms.

Basilissa alta Watson (*loc. cit.*, p. 597).

Station 43, 339 fms.

Basilissa costulata Watson (*loc. cit.*, p. 600).

Yucatan Strait, 640 fms. Sigsbee, Station 50, 119 fms; Sand Key, 15 fms.

I apply this name provisionally to a shell which may prove to be the adult of Watson's species, but which requires further investigation. If so, the mouth is well provided with thick internal denticulations when grown, and the pillar is stout and involved. It seems to have no operculum !

Leptothyra (induta var. ?) **albida** n. s.

Shell stout, solid, heavy, very nacreous, variable in form and sculpture, rather elevated for the genus, dead white or brownish externally, with the usual solid shelly operculum. Whorls five, rounded, apex obtuse, suture distinct ; sculpture of stout revolving ribs, varying from three to six on the upper side of the whorl crossed by slight plications, most noticeable just below the sutures, but distinguishable also on the base ; the ribs may be few and widely separated, or numerous and close set ; they may near the sutures be nodulated by the plications, or not; the base is usually more finely sculptured and sometimes quite smooth except for lines of growth. Aperture quite oblique; pillar with a blunt tooth as in other species of the genus; lip somewhat reflected, thickened inside, basal callus not very thick. Alt. 7.0±. Maj. diam. 6.75±.

Sand Key, 125 fms.; Station 2, 805 fms.; Sigsbee, off Havana, 450 fms.; off Cape San Antonio, 1,002 fms.; Yucatan Strait, 640 fms.

This shell is so variable that I should be disposed to think Watson's *Turbo* (*Collonia*) *indutus* a mere abnormally smooth specimen, were it not that he does not figure the tooth on the pillar. It is very probable, however, that they will turn out to be varieties of the same species.

CALLOGAZA n. g.

Shell resembling *Gaza* Watson, but with the umbilical pad reflected only partly over the umbilicus; the pillar straight, passing without notch or mucronation into the reflected basal margin of the aperture; nacreous layer in this shell covered with a thin non-nacreous layer, which, in its turn, appears to be covered by a delicate epidermis. A marked feature in *Gaza* is the mucronate pillar, which gives it much the aspect of an *Alcadia*, while the umbilicus is wholly covered and the shell wholly nacreous. Were it not that I have several forms agreeing in character, and in these differences, I should have hesitated to separate them from *Gaza*. Such differences, however, are held to have considerable value in littoral forms, and, until we know to the contrary, cannot in abyssal species be held to be valueless. It is probably allied to *Gaza*, and has a similar operculum.

Callogaza superba n. s.

Shell in general features recalling *Gaza dædala* Watson, much of whose description would apply with little change to this species. Whorls eight, in the adult roundly shouldered below the suture, rounded at the periphery, somewhat flattened on the base, deeply and widely umbilicated, the umbilicus a little more than half covered by a nacreous callus; first two and a half whorls transparent, not nacreous, very obtuse, the nucleus not prominent; the next three and a half whorls smooth, except for faintest lines of growth, glassy with the nacre shining through; the remainder of the shell covered with delicate and distinct lines of growth, sometimes a little more pronounced near the suture, and by revolving lines almost too shallow to be called grooves, most prominent on the periphery, evanescent on the flattened part of the base and above near the suture; on the last whorl these are about 0.5 mm. apart; the region near the suture is almost smooth. Suture very distinct, but not channelled; umbilicus bordered by an edge from which the flattened base falls away, and with straight walls forming an almost perfect cone; last whorl contracted just before the reflected lip, which, above, rounds out in advance of its junction with the suture, the last quarter of an inch of which descends on the whorl, giving the aperture a downward look ; aperture oblique above, arching more nearly to a perpendicular below ; smoothly, evenly reflected and thickened from the pillar to the suture, with an internal channel behind the thickening ; pillar callous above, thinly and unevenly reflected half-way across the umbilicus, gently and very obliquely descending and smoothly passing into the basal part of the lip. The interior of the aperture, the lip, the umbilical callus, and a slight wash near the sutural junction, brilliantly nacreous ; base and body whorl within the mouth not so ; upper surface of shell distinctly tinted with fawn color, base waxen white, the nacre perceptible through the thinner portions. Alt. 24.0 ; Maj. diam. 35.5 ; of umbilicus, 8.0 ; of aperture, 13.0 mm. Defl. about 100°.

Station 153, off Montserrat, 303 fms., and from various other localities at about the same depth.

This shell, except for the nacre, at once recalls a big *Helix* of the *albolabris* type.

Callogaza Watsoni n. s.

Shell much smaller than the last and but slightly nacreous; whorls six and a quarter, having the same general form as in the last species, but with a more prominent nucleus ; nucleus small, bulbous, dark brown ; first two and a half whorls glassy, brown spotted, smooth ; subsequently the exterior two thirds of the upper surface of the whorls sculptured with four or five strong revolving threads ; the space between them and the suture above, with strong, even, flexuously radiating, shining, rounded plications (about eight to a millimeter) which pass obliquely over the revolving threads and appear again on the base as strong regular plications in the umbilical region, extending from the umbilical carina one third of the way toward the periphery. The base is covered with numerous revolving threads flattened until their interspaces appear like grooves ; the umbilicus similarly formed to the last species, but somewhat more turreted internally. Last whorl less contracted behind the lip, which is not produced forward above, as in *superba ;* the umbilical callus not nacreous, with a granular surface, white and covering less than half the umbilicus ; lip and aperture otherwise much the same as in *superba*, but only slightly nacreous. Base waxy white, top the same, with cloudy radiating brown blotches near the suture and on the periphery ; some of the revolving threads are also continuously brown. Alt. 7.75. Maj. diam. 12.5 ; of umbilicus, 2.5 ; of aperture, 5.5 mm. Defl. about 120°.

Sigsbee, Station 12, 177 fms., off Havana.

This modest little species looks very like some of Lowe's Madeiran helices.

MICROGAZA n. subg.

Shell flattened, rotelliform, resembling a *Gaza* without reflected lip or umbilical callus, brilliantly nacreous when fresh, and having a distinctly scalariform umbilicus.

This little shell I at first supposed to be the young of the preceding species, but a careful examination of many specimens has shown that this is not the case, and there is no evidence to indicate immaturity. The close resemblance in the other characters leads to the supposition that it is related to *Callogaza*, of which until more is known it will form a subdivision.

Microgaza rotella n. s.

Shell depressed, with five whorls, somewhat flattened above and below ; nucleus small, translucent white, and with the two first whorls polished, smooth or marked only by faint growth-lines ; remainder of the whorls with a narrow puckered band revolving immediately below the suture, on which the shell matter is as it were pinched up into slight elevations at regular intervals, about half a millimeter apart. In some specimens, outside of this band an impressed line revolves with the shell ; remainder smooth, shining or with evanescent traces of revolving lines impressed from within and strongest about the rounded periphery ; base rounded toward the umbilical carina over which it seems to be drawn into flexuously radiating well-marked plications (about thirty-two on the last turn) which disappear a third of the way toward the periphery ; walls of the umbilicus concave, overhung by the carina, turns of the shell so coiled that the part of each whorl uncovered by its successor forms a narrow spiral plane ascending to the apex like a spiral staircase or screw thread. Pillar straight, thin, with no callus ; aperture rounded except at the angle of the umbilical carina ; margin thin, sharp, not reflected or thickened ; no callus on the body whorl in the aperture ; shell whitish or greenish ; nacre less brilliant in dead or deep-water specimens ; with zigzag brown lines variously transversely disposed and disappearing on the base. Alt. 4.0. Maj. diam. 6.75 ; of umbilicus, 1.75 ; of aperture, 2.5 mm.

Station 2, 805 fms. Barbados, 100 fms., etc.

The coloration recalls that of some species of *Cyclotus.*

FLUXINA n. g.

Shell porcellanous, depressed conical, umbilicate, strongly carinate, with a stout umbilical rib, above which the pillar is thin and emarginate; from the umbilical rib to the carina the basal margin of the aperture is deeply flexuously emarginate ; above the carina it is again but less deeply emarginate, then sweeps forward roundly and then slightly recedes before joining the preceding whorl.

This curious form belongs in all probability to the *Solariidæ ;* representing among them *Basilissa* among the *Trochidæ*, and recalling *Platyschisma,* but with a different aperture. When perfect the margin at the carina must project forward like a claw, or nail, as in *Schizostoma.* When adult, the nuclear whorls are filled up with a solid deposit of shelly matter, and it is probable that there is a slight notch at the end of the umbilical rib.

Fluxina brunnea n. s.

Shell large, solid, depressed, with five to seven whorls ; light brown with a few touches of white transverse to the whorls on the carina ; umbilical rib white ; nucleus and interior walls of the umbilicus dark brown. Several of the spiral grooves above and below are marked by a darker brown than the rest, and appear as brown lines. Sculpture above, on the nuclear whorls, of close-set sharp longitudinal grooves with the ridges between them rounded and more or less beaded or nodulous, crossed by more or less evident lines of growth, which, however, are not necessarily coincident with the beading where present ; the grooves continue, but do not seem to increase in number, while all sculpture disappears from between them, the interspaces being smooth and flat and only marked by very light lines of growth. The carina is separated from the rest of the whorl by a squarish shallow gutter, somewhat too broad to be termed a groove, while the base rounds up over the periphery so that the most angular edge of the carina is at the top ; base between flat and rounded, marked by evanescent (partly brown) grooves and transversely by delicate flexuous slightly raised aggregations of the lines of growth at somewhat regular intervals ; these slightly crenate the umbilical rib on its inner edge and perhaps form the pronounced, slightly backwardly flexed, striæ and ridges which mark the umbilical walls. There is hardly any callus on the body wall at the aperture, which is broken in the specimens at hand ; its form has been made out from the lines of growth ; the suture in the later whorls is closely appressed, the carinal gutter would at first sight be taken for it ; the first two and a half whorls are solidly filled with translucent shelly matter. Alt. of base, 6.0 ; of spire, 4.75. Diam. of base, 15.5 ; of umbilicus, 3.12. Width of aperture, 7.0 mm.

Station 2, 805 fms., and in other localities which will hereafter be enumerated.

Ethalia anomala D'Orbigny.

Yucatan Strait, 640 fms.

Turbo (Liotia?) Briareus n. s.

Shell small, elevated, with an obtuse apex and five rounded whorls. Nucleus flattened, lemon-yellow, looking like a little *Delphinula ;* the remainder whitish with the backs of the spines streaked with rose color, or the whole shell (except the nucleus) of a darker shade of rose ; nucleus with transverse ridges ; next whorl and a half with spiny rugosities, spirally arranged ; remainder, above, with four or five revolving ridges close set with hollow spines resembling little curved tubes slit down on the anterior side, a millimeter long (or less) but sometimes dwarfed, thickened and stunted ; a thread with smaller spines just below the periphery (or appearing just at the suture in earlier whorls) inside of which are three strong ribs closely nodulated, then a very pronounced umbilical rib coarsely nodulated, then three rows of small spines which twist into the umbilicus, above which its walls are smooth, but twisted so that the proper perforation is very small. The whole shell moreover is covered with the lines of growth which rise into elegantly imbricated scales, regular on the base, irregular on top, where they produce by their irregularity a shagreened effect. Aperture circular, thickened in the adult; pearly substance of the shell thick and solid. Alt. 7.5. Maj. diam. 9.0. Diam. of aperture, 3.5 mm.

Station 2, 805 fms. Station 60, off Havana, 480 fms.

This may belong to the subgenus *Arene* H. & A. Adams. Contrary to the ordinary experience, those from the deeper water are the darker and smaller specimens.

This shell is a perfect little gem. Words can give but little idea of its beauty under a magnifier.

Hanleyia tropicalis n. s

Dall, Sci. Results Expl. Alaska, Art. IV. p. 101, Dec. 1878 (name only).

Chiton about 10.0 mm. in length and 5.0 mm. in width, with the usual characters of the genus, i. e. anterior valve with an unslit insertion plate, other valves without even the plates; back with an angle of about 90°. Girdle in the dried specimens thin, narrow, covered with close-set, white, glassy, slender spines (1.0–1.5 mm. in length) above, and below with similar but much shorter ones. Anterior valve with a well-marked mucro from which proceed concentric striæ of growth, and in front of which the valve is a little concave; sculpture of little tessellated flattened nodules radiating from the mucro, above which are irregularly distributed small opaque white pustular bubbles of shelly matter looking like attached grains of coral sand; posterior valve smaller, flatter, with similar sculpture, but the pustules take on a decidedly cylindrical shape and are elongated, looking like the stalks of decapitated mushrooms; this arrangement is still more marked on the posterior lateral areas of the intermediate valves, the anterior lateral areas also exhibit it (less prominently), but with an obliquely antero-posterior radiation, while the former have it more entirely lateral from the mucrones; dorsal areas with the tessellated sculpture alone, arranged longitudinally. Color entirely white.

Pourtalès, Sand Key, 128 fms.

This is the first known species of the group from the waters of the tropics, and is entirely distinct in sculpture and appearance from the others.

GENUS PLEUROTOMA Lam.

ANCISTROSYRINX n. subg.

Shell with the posterior surface of the whorls concave, with a broad deep sinus, bordered externally by a pectinated elevated frill, directed backwards.

Understanding that the name *Candelabrum,* used (but not described) for this form (Bull. M. C. Z., Vol. V., 1878), has been used by Blainville for an echinoderm, I propose to adopt the above designation for the group typified by the following species.

Ancistrosyrinx elegans n. s.

Candelabrum cathedralis DALL, *l. c.* (named, but not described).

Shell with the canal about the same length as the spire, acutely tapering before and behind ; white ; whorls nine, of which two are embryonic ; aperture very long and narrow ; anterior surface of the whorls everywhere sculptured with even uniform spiral rows of rounded nodules beautifully reticulated by the lines of growth ; one row about the middle of the whorl slightly elevated above the others ; carina fringed with delicate triangular points ; posterior surface of the whorls, except for lines of growth, smooth, with one row of nodules just inside the carina ; canal straight, columella not thickened, but somewhat twisted anteriorly, outer lip sharply angulated by the carina. Length 27 mm., of which 12 mm. are behind the carinal notch. Max. width, 12 mm. Width of aperture, 4 mm. Defl. 45°.

Florida Reefs, Pourtalès, 1870. Station 2, 805 fathoms, four miles from Havana, Agassiz, 1877–78.

This is a most exquisite gem of the sea, and will not fit into any of the sections of *Pleurotomidæ* yet eliminated from the Lamarckian genus.

SUBGENUS BELA LEACH.

The subdivisions of the *Pleurotomidæ* are at present so indistinctly limited and so poorly defined by diagnosis ; the differences of authors in regard to which groups should be taken as of full generic value are so great, and the difficulty of decision in the absence of the soft parts so perplexing ; that for the present purpose I shall regard the groups as merely subdivisions of the Lamarckian genus, recognizing of course that some of them, when properly eliminated, are entitled to generic separation.

P. (Bela) Blakeana n. s.

Shell very variable in proportions and somewhat variable in sculpture ; thin, white, with a dark nucleus, rather acute spire, short pillar and rather wide aperture ; sculpture of revolving threads, two stronger ones immediately in front of the suture, which are nodulated at their intersection with the ribs ; with sixteen to eighteen transverse ribs which are strongest near the suture and fade away toward the canal ; notch subobsolete ; shell with the waxy polish characteristic of so many abyssal forms.

Var. **normalis.**

Shell short and very stout, seven-whorled, the last whorl about eight elevenths of the whole length ; extreme nucleus smooth ; remainder of the three and a half nuclear whorls yellow-brown, beautifully reticulated with wavy transverse lines, then changing suddenly into waxy white ; remainder of shell with spiral threads, set in pairs which frequently blend to make one flattened spiral thread, with wider interspaces between the threads. Two or three threads next the suture are stronger and wider apart than the others, the outer one strongest, giving the whorl a turreted appearance, and rising into little knobs on the transverse ridges ; these ridges rather sharp, sixteen to eighteen in number, fading away toward the canal in most but not all specimens, flexuous with the lines of growth ; pillar straight, the edge obliquely cut off, shorter than the aperture anteriorly ; a light deposit of callus on the body ; aperture proportionally wide, thin-lipped, about half as long as the shell. Lon. 8.25. Lat. 5.25 mm. Defl. very variable.

Off Cape San Antonio, 640 fms. Yucatan Strait, 640 fms.

Var. **extensa.**

Shell in most features like the last, but more elongated, with nine whorls, the revolving threads (except the sutural ones) obsolete except near the anterior end of the last whorl ; with a tendency of the thread next the suture to be stronger and more strongly knobbed than (as in the normal form) the outer one ; the transverse threads twenty to twenty-five, more numerous and in large specimens hardly noticeable except near the suture ; spire nearly equal to the last whorl and aperture about one third of the shell. Lon. 12.5. Lat. 5.0 mm.

Off Cape San Antonio, 640 fms., 413 fms. Station 35, Lat. 23° 52′, Lon. 88° 58′ W , 804 fms.

The sutural knobbing characterizes so many abyssal shells that it would seem to have some significance, but what it is we are not yet able to determine.

P. (Bela) limacina n. s.

Shell waxy white, smooth, glistening, elongated, rather acute at both extremities ; whorls eight or nine, the nucleus and nuclear ones as in the last except that they are less strongly sculptured ; next the suture, which is by them distinctly marked, a succession of (on the last whorl sixteen) little squarish knobs, not continued anteriorly in any way, but looking as if they had been pinched up from the interspaces between them ; on the back of the canal are two or three spiral threads, remainder of shell without trace of spiral sculpture ; lines of growth very flexuous, indicating a deep broad emargination near the suture ; but the shell is so excessively thin and brittle that I can find, among many specimens, none with a perfect aperture, but suppose from the growth lines that the outer lip was rounded out broadly, while the canal is very narrow, the pillar extremely thin, sharp and straight, making the aperture narrowly lunate. There are variations in slenderness and in the prominence of the sutural knobs, otherwise this is one of the most characteristic abyssal species and wholly unlike any of the shallow-water Belas. Last whorl twenty-seven forty-fourths of the shell. Lon. 11.0. Lat. 4.0 mm. Aperture equal to the spire above the last whorl.

Station 2, 805 fms. Yucatan Strait, 640 fms. Gulf Stream, 447 fms., Pourtalès.

P. (Bela) filifera n. s.

Shell thin, delicate, elongated, fusiform, waxy white ; nuclear whorls three, generally decorticated, but when perfect probably as in the preceding species; whorls in all ten, near the suture smooth except for the distinct lines of growth indicating the deep wide notch ; suture appressed, indistinct ; elsewhere sculptured with numerous nearly uniform flattened revolving threads with about equal interspaces ; otherwise with obliquely transverse elevations, hardly limited sharply enough to call ribs ; these appear just below the sutural smooth band (sixteen on last whorl), cross the whorls of the spire with a slight angulation above the middle of those whorls, but on the last whorl disappear at about the periphery ; tolerably evident lines of growth appear here and there, crossing the spiral sculpture ; spire less than one third of the shell ; aperture a little less than half the length of the shell; pillar straight, simple, polished. Lon. 17.5. Lat. 6.25 mm.

Station 47, 331 fms.

A remarkably elegant species, which resembles none of the Northern forms.

P. (Genota) mitrella n. s.

Shell white, strong, acutely fusiform, nine-whorled ; nucleus and two nuclear whorls rounded, smooth, shining, white ; spiral sculpture consisting of two small threads next before the suture separated, by a smoother excavated space representing the notch, from two or three or even four strong flattened threads (the second of which forms the periphery) which distinctly overlie the transverse sculpture, are continued on the last whorl to the canal, and number about twenty-two ; beside these the entire surface is overscored with very minute microscopic spiral striæ ; the transverse sculpture is of twelve to fourteen sharp straight ridges, continuous from the earlier whorls to the last one, except on the final half of the latter and on its anterior two thirds where they become obsolete ; suture appressed, indistinct ; column straight, simple ; outer lip slightly excavated (for the notch) just in advance of the suture, then broadly projecting with its edge somewhat thickened, then falling away toward the canal with a thinner edge ; aperture long, narrow, somewhat less than half as long as the shell, internally smooth. Lon. 12.5. Lon. of last whorl, 7.25. Lat. 4.25. Lat. of aperture, 1.4 mm.

Yucatan Strait, 640 fms.

This little species has much the aspect of a small acute rough-sculptured *Mitra*.

P. (Pleurotomella) Verrillii n. s.

Shell eleven-whorled, thin, large, bluish white, with an acute spire and wide twisted canal ; nucleus thin, smooth ; next three or four whorls smooth, shining, with a spiral row of little polished knobs just behind the suture ; thence the entire shell covered with hardly raised spiral flattened threads about equal to the very shallow interspaces, and averaging about four to a millimeter ; the knobs continue in front of the ante-sutural excavation, but in the later whorls have a more pinched appearance ; there are twenty-one on the last whorl ; suture appressed, obscure ; notch broad, shallow, rounded, the ante-sutural band on the last whorl somewhat concave and about four millimeters wide ; lip much produced forward, rounded, falling away toward the canal, which at its anterior end is broad and flaring ; pillar stout, simple with a sharp thin twisted edge and no callus ; aperture equal to half the shell in length and width. Lon. 36.0 ; of last whorl, 25.0. Max. lat. 12.0 mm.

Station 41, 860 fms.

This is supposed from the shell characters to belong to Prof. Verrill's subgenus *Pleurotomella*, and, so far as his descriptions go, seems not to be identical with any of those described by him alone or jointly with Mr. Sanderson Smith. Whether the subgenus itself can stand will only be determined when the soft parts of the numerous other named divisions of *Pleurotoma* have been critically examined and compared. Meanwhile it is a convenient receptacle for a few forms which seem to differ in several particulars from those diagnosed in the text-books, or by writers on the subject.

P. (Pleurotomella?) Sigsbei n. s.

Shell in general closely resembling the last, with the following differences : it has the same number of whorls in 25.5 mm. length ; it is proportionally more slender ; the knobs are oblique instead of perpendicular, in the spire are set in the middle of the whorls instead of near the suture, are less prominent, and become obsolete toward the end of the last whorl ; there are about eighteen on the last whorl that has them, and they are proportionally more produced than in the last ; the pillar is less twisted and the sharp flaring edge near the anterior end is not so prominent ; the nucleus is smooth and light brown ; the remainder of the shell has a brownish tinge compared with the preceding. Lon. 25.5 ; of last whorl, 15.0 ; of aperture, 11.75. Max. lat. 9.5 mm.

Station 33, 1,568 fms. Yucatan Strait, 640 fms. (young).

The spiral threads in this and the last species cover the ante-sutural band as strongly as any part of the shell.

P. (Mangilia?) ipara n. s.

Shell with nine whorls ; nucleus minute, dark brown, polished, smooth ; second and third nuclear whorls beautifully reticulated by oblique transverse lines in two directions; remainder waxy white, with the peculiar waxy lustre of abyssal shells; form rather short-fusiform, spire subturreted by the concave ante-sutural band; spiral sculpture of about twenty-four flattened threads, with wider interspaces, before the band on the last whorl; only two or three of these threads visible on the upper whorls; they pass over all the transverse ridges and are a little stronger over them. Next the suture are small, short, appressed plications, with a tendency to pair, and even to unite above, thus becoming staple-shaped; the ante-sutural band is excavated, smooth except for the terminations of the plicæ, which cease near its posterior border; near the anterior border the spiral threads begin, crossing sharply-projecting short oblique plications (thirteen on the last whorl) which disappear half-way from the periphery to the anterior end of the canal, and are somewhat angulated just in advance of the ante-sutural band; notch broad and deep; outer lip thin, projecting; pillar short, thin, twisted; canal short, broad. Lon. 8.5; of last whorl, 5.75; of aperture, 4.5. Max. lat. 4.5 mm.

Yucatan Strait, 640 fms.

There is some variation in form and sculpture of this species; the above is from a perfect specimen of average characters. I suspect it to be a *Bela;* the form of the notch, however, more nearly resembles what is usually understood by *Mangilia.* It has no resemblance to any of the Northern forms.

P. (Mangilia) comatotropis n. s.

Shell white, porcellanous, eight-whorled; first three whorls with ten to eighteen distinct deeply flexuous transverse riblets and a narrow longitudinal belt near the suture; succeeding rather abruptly to this the sculpture of the remaining whorls consists of (on the earlier ones) two or three, or (on the last whorl) up to eleven sharp revolving ridges, the one next before the suture being the most prominent; these are crossed by delicate distinct raised lines following the lines of growth (on the last whorl about twelve to one millimeter) which are most evident in the interspaces; suture appressed from above and below, forming a grooved, slightly projecting riblet; notch not deep, less than semicircular; aperture rather narrow and short; pillar smooth, entirely free from callus; margins simple, not thickened. Lon. of shell, 6.0; of last whorl, 3.75; of aperture, 2.5. Lat. of last whorl, 2.5; of aperture, 1.0 mm. Defl. about 27°.

Cape San Antonio, 640 fms.

This somewhat recalls the comparatively gigantic *Pleurotoma oxytropis* Sby. and *Drillia Kennicottii* Dall, but is clearly not the young of any described species.

P. (Mangilia) lissotropis n. s.

Shell small, slender, somewhat bluntly tipped, with six whorls, shining with the lustre of paraffine; nucleus rather large, bullate, smooth, translucent, shining; remaining whorls with transverse, stout, shouldered ribs (on the last whorl eleven) becoming obsolete anteriorly, and succeeded by a few (four or five) revolving riblets at the anterior extreme of the canal; suture appressed; lines of growth not evident; whorls rather inflated in appearance; notch very slight; aperture small and unusually short; pillar very short, straight, and pointed. Lon. of shell 4.5; of last whorl 2.25; of aperture, 1.25. Lat. of last whorl, 1.75 mm. Defl. about 27°.

Station 20, 220 fms.

This very likely grows to larger size, and is notable for its peculiar translucent waxy lustre.

P. (Mangilia) bandella n. s.

Shell thin, white, polished, fusiform, eight-whorled; nucleus smooth; succeeding whorl or two scalariform, by reason of sharp scale-like transverse lamellæ; remaining whorls with sharp transverse ridges prominent on the spire and on the posterior half of the last whorl (where there are eighteen of them) and obsolete on the anterior half; these ridges rise into points where they cross the carina in front of the notch-band and the ante-sutural rib; of other transverse sculpture there are only the lines of growth which are prominent only where they cross the band marking the track of the notch; the revolving sculpture consists of a rather stout rib closely appressed to the suture forming one margin of the band, the other edge of which forms a carina, in advance of which are (on the last whorl 20 – 23) flattened riblets with about equal interspaces which extend with regularity to the anterior end of the canal. Aperture equal to half the total length, margins and column thin; notch broad, shallow, leaving a very distinct band; spire moderately pointed. Lon. of shell, 9.37; of last whorl, 6.12; lat. of do., 3.75 mm. Defl. about 39°.

Station 47, 321 fms.

This has a superficial resemblance to the *Bela turricula* group, which is less evident on a closer inspection. It has the deep-water facies and (as will be observed) the sutural band with raised sculpture common to so many other abyssal species of totally different genera or even orders.

P. (Mangilia) antonia n. s.

This species at first sight appears like a variety of the last, and is best described by a differential diagnosis. It is six-whorled, with a length of 5.75 mm.; the nucleus is clear brown instead of white, with three whorls, on most of which there are scalar ridges which are much more closely and regularly set than in the last, and do not resemble lamellæ; there is only a trace of an ante-sutural revolving rib in the earlier whorls which vanishes entirely in the later ones, and with it, of course, the tendency to raised points of sculpture; though its place is marked by a white opacity in the otherwise rather translucent shell; there are thirteen longitudinal ribs on the last whorl, which extend on to the anterior fourth of the whorl instead of vanishing, and are more evident and sharper where they cross the band; while the revolving ribs are less regular and extend partially over the notch-band, which is thus rendered much less conspicuous than in the last species; the notch is also less marked and the spire has a stouter aspect. Lon. of shell, 5.75; of last whorl, 4.25; of aperture, 3.0. Lat. of last whorl, 2.5 mm. Defl. about 41°

Cape San Antonio, 640 fms.

P. (Mangilia) Pourtalesii n. s.

Shell slender, dull, light brown, eight-whorled; nucleus large, bubble-shaped, smooth, forming a blunt apex; other whorls furnished with numerous (on the whorl next to the last 20, and on the last 27) narrow, little-raised, rounded riblets with somewhat wider interspaces, becoming less distinct and more crowded in the adult near the aperture; the posterior terminations of these riblets are waved, forming an obscure notch-band, each being slightly enlarged close by the suture and also on the anterior side of the band, thus forming two rows of indistinct nodulations, of which the sutural row is more clearly defined than the other; the riblets extend from suture to suture, and near its anterior third become obsolete on the last whorl; here eight or ten rather indistinct revolving threads exist, becoming more distinct toward the end of the canal, separated from each other by shallow grooves; these pass round the column into the aperture; canal short, wide; aperture simple, with thin margins; notch rather indistinct in the adult. Lon. of shell, 17.0; of last whorl, 9.5; of aperture, 7.0. Lat. of last whorl, 6.0; of aperture, 2.0 mm. Defl. about 25°.

Bed of the Gulf Stream, Pourtalès, in 447 fms.

An inconspicuous but well-marked species.

P. (Mangilia) columbella n. s.

Shell whitish, inclining to dove-color, slightly translucent, thin, delicate, with eight and a half sub-turreted whorls; nucleus minute, shining, glassy, transparent; succeeding whorls regularly sculptured by transverse slightly oblique riblets, about twenty on the last whorl but one, extending from suture to suture on the spire, somewhat shouldered before the suture giving the spire a sub-turreted appearance, becoming less numerous, regular and prominent on the last whorl, and vanishing at or before reaching its periphery; revolving sculpture of close microscopic striæ often elegantly waved, covering the whole surface except the apical whorls; column short, straight, simple, with a groove behind it, forming a distinct siphonal fasciole; notch very shallow and inconspicuous; outer margin thin, simple; canal very short and wide; aperture almost lunate. Lon. of shell, 10.0; of last whorl, 6.5; of aperture, 4.5. Lat. of shell, 4.5; of aperture, 1.8 mm. Defl. about 36°.

Station 20, 220 fms.

This is one of the species which, in the absence of the soft parts, is difficult to locate. It is possible it should be referred to *Bela*. It is not unlike one or two Arctic species.

P. (Mangilia) pelagia n. s.

Shell slender, thin, white, smooth but not polished, with eight whorls; nucleus small, three apical whorls inflated, white, perfectly smooth; remainder indistinctly keeled midway between the sutures by a ridge, over which, the lines of growth passing obliquely, the shell is as it were pinched up at regular intervals into oblique projections, ten to fourteen on each whorl, fewer proportionally on the larger whorls; shell otherwise not sculptured; suture distinct, not appressed; canal and aperture long and narrow, notch well marked, but not forming a distinct band. Lon. of shell, 10.75; of last whorl, 7.25; of aperture, 5.25. Lat. of shell, (about) 3.5 mm.

Station 44, 539 fms.

This is distinctly abyssal in its facies. The specimen, though somewhat imperfect, presents such distinct and recognizable characters as to authorize its description. Other specimens will doubtless be found in the Agassiz-Bartlett series as yet untouched. Its generic place is, like that of the last-mentioned species, a little uncertain as between *Bela* and *Mangilia*.

P. (Drillia) polytorta n. s.

Shell large, slender, solid, with about thirteen whorls, of a dull ashen color and unpolished surface; nucleus —— ?; succeeding whorls transversely sculptured by twelve or thirteen rounded, shouldered ribs, beginning and largest just before the notch-band, crossing the whorls a little obliquely or even in a directly transverse direction, widest at the beginning, becoming narrower and less prominent anteriorly, on the last whorl fading out or indistinct on the anterior half, and less numerous or partially obliterated over the latter part of this whorl in fully developed adults; the lines of growth are more or less distinct, but not uniform, while the ribs on one whorl bear no uniform relation in position to those on the next or preceding whorls; longitudinally each whorl is appressed in a thickened band against the suture, next in front of which band is the (except on the last half-whorl) narrow unsculptured band indicating the path of the notch; this on the last half-whorl widens out considerably if the specimen in hand be typical, though in this case it may be an individual characteristic; before the notch-band, and even encroaching a little on it, and extending over the surface of the whorls, are six or seven (on the last whorl seventeen) slightly raised rounded revolving lines, with slightly wider shallow interspaces, which are about equally prominent over the transverse ribs and between them; other sculpture none; aperture rather short and narrow, slightly more than one third the whole length of the shell; outer lip probably thickened; a considerable amount of smooth callus on the body whorl and pillar; notch rather narrow, of variable depth at different stages; canal short, rather open, nearly straight; last whorl less than half the length of the shell. Lon. 33.5. Max. diam. 8.0. Lat. of aperture, 5.5 mm. Defl. about 27°.

Off Cape San Antonio, 413 fms.

A rather large, subcylindrical, coarse-looking shell, without specially pronounced characters, yet seemingly not to be affiliated with any of the species described and figured with which I have been able to compare it.

P. (Drillia) subsida n. s.

Shell stout, solid, fusiform, waxy white, with nine whorls ; nucleus brown, smooth, first three (nuclear) whorls sculptured with neat flexuous ribs transversely disposed ; next four whorls transversely with only the rather strong and distinct rounded lines of growth which cover pretty much all the rest of the shell except the tops of the longitudinal riblets ; the longitudinal sculpture a keel just in advance of the suture upon which the posterior edge of the former is appressed, then a few faint revolving striæ on the broad notch-band, then two more keels, or sharp squarish riblets (on the last whorl ten or twelve), the first marked with numerous knobby waves extending forward in the interspace toward the second keel rather than outwardly, and sometimes meeting and slightly waving the second keel ; these waves make their appearance on about the fifth whorl, and are evanescent on the last whorl ; there are about three in a millimeter and a half ; aperture narrow, slightly callous ; canal short, nearly straight ; pillar covered with thin, translucent white callus ; outer lip not thickened, but might become so in an older shell. Lon. of shell, 13.0 ; of last whorl, 8.0 ; of aperture, 6.0. Max. lat. 5.0 mm. Defl. about 42°.

Station 43, 339 fathoms.

A solid, stout, clear-cut species, allied to *Drillia Kennicottii* Dall, of Alaska, but shorter and more spindle-shaped.

P. (Drillia) nucleata n. s.

Shell polished, waxy white, seven or eight whorled ; nucleus disproportionately large, smooth at first, shining, very obtuse, white ; second whorl with about fifteen rather sharp transverse ridges parallel with the axis, and not flexuous ; these pass gradually into slightly oblique, rounded riblets, which begin in front of the notch-band with a slight shoulder, then continue across the whorl, and are somewhat attenuated by the time they reach the suture ; of these there are about fifteen on the last whorl, less distinct anteriorly ; the lines of growth are tolerably prominent, and especially so on the last whorl. Of revolving sculpture there is little or none; a few microscopic revolving striæ are perceptible in some places, especially on the surface of the rather broad notch-band ; the suture is appressed ; the shouldering of the riblets gives the upper whorls a rather inflated appearance ; the aperture is short and wide ; the notch deep, with its edges turned up and a little twisted ; the canal short, wide, slightly reflected, showing on the pillar a distinct fasciole ; pillar straight, with a distinct callus upon it and also upon the body-whorl ; outer lip thin-edged, produced and rounded. Lon. of shell, 13.5 ; of last whorl, 9.5 ; of aperture, 5.0. Max. lat. 5.0 ; lat. of aperture, 2.0 mm. Defl. about 29°.

Station 43, 339 fms.

A modest and distinct little species, remarkable for its stout obtuse and unusually large nucleus.

P. (Drillia) exasperata n. s.

Shell yellowish-white, with a dull surface, except for the glassy and translucent nucleus, slender, thin, eight-whorled; nucleus thin, inflated, the (nuclear) first two whorls polished, smooth, and free from sculpture, passing abruptly into the dull and lustreless surface of the adult shell; for the remainder, the transverse sculpture consists of subequal ribs, largest on the periphery, smaller toward the sutures, which they reach above and below, the track of the notch not being marked by a flattened band, as is generally the case; there are about eleven of these to a whorl, on the last whorl they are less pronounced, and become obsolete toward the anterior third of the whorl, where the lines of growth are particularly conspicuous; the completion of the adult aperture is marked by a particularly large rib or swelling of the margin, which becomes more conspicuous in case the shell continues to grow; in the older part of the shell the ribs are continued in the same line from whorl to whorl, in the last whorl and a half they become alternate or irregular; the revolving sculpture consists of (on the smaller whorls) two or three to (on the last whorl) sixteen flattened raised bands, with wider interspaces, which are much more marked, or even knobby, on the smaller whorls where they pass over the transverse ribs, gradually become more uniform, and, on the last whorl, are nearly as well defined between the ribs as on them; nine of those on the last whorl are crowded together on the anterior third, the rest spread over the body of the whorl; there are hardly any traces of revolving striation; notch deep, but not producing a band; margin of the aperture thin, the outer lip produced forward, a slight deposit on the body and pillar; columella nearly straight, slightly shorter than the rather wide, somewhat recurved canal; sutures appressed, sinuous over the ends of the transverse ribs; aperture less than one third of the shell. Lon. of shell, 9.5; of last whorl, 5.0; of aperture, 3.0. Max. lat. 3.5 mm. Defl. about 27°.

Off Cape San Antonio, 1002 fms.

A rough-looking little shell, with somewhat the sculpture of a *Cerithiopsis.*

P. (Drillia?) leucomata n. s.

Shell more or less translucent white, short-fusiform, thin, polished, ten-whorled; nucleus thin, very minute, inflated, clear transparent brown, with a shining surface; succeeding to it are three nuclear whorls, whitish brown, smooth, but not shining like the nucleus, subinflated, and with a sharp, strong, peripheral keel; succeeding whorls marked by a strongly defined broad band extending from the suture more than half-way over the whorl, descending steeply to the periphery, where the keel of the nuclear whorls is continued as two sharp raised threads which pass over strong oblique angular transverse projections, are clearly defined in the smaller whorls, but on the later ones become obsolete ; on the last whorl (about six on the middle and nine on the anterior third) in advance of the peripheral nodules are about fifteen sharply raised threads, with interspaces up to 0.5 mm. in width ; other revolving sculpture consisting of microscopic striæ covering the shell, which in favorable localities in crossing the lines of growth (as, for instance, on the notch-band) occasionally give rise to microscopic shagreening, invisible except in a good light and under a good lens ; transverse sculpture consisting only of generally faint lines of growth, and the oblique nodosities above mentioned, which extend on the posterior whorls from the periphery to the suture, and on the last whorl are proportionally smaller ; these vary from eleven to thirteen in number per whorl ; aperture narrow, outer lip much produced forward, columella twisted and the canal rather wide and somewhat recurved ; deposit on the body whorl and pillar very slight ; notch wide, reaching nearly or quite to the suture : margins all thin. Lon. of shell, 13.5 ; of last whorl, 7.5 ; of aperture, 5.75. Max. lat. 5.25 mm. Defl. about 38°.

Station 48, 533 fms.

It is uncertain whether this should go in *Drillia* or *Pleurotomella* in the present perplexing condition of the *Pleurotomidæ* and without any characters from the soft parts. The nucleus is, however, precisely the same as in several species which, so far as external characters go, may be considered typical Drillias.

P. (Drillia) gratula n. s.

Shell slender, acute, white, smooth, but not polished, with ten or eleven whorls when adult ; nuclear whorls as in the last, except that the nucleus itself is smaller and more acute ; notch-band narrower, occupying only about a quarter of the surface in the smaller whorls, and descending but slightly, thus giving a somewhat turreted aspect to the spire ; transverse sculpture consisting of eleven to (on the last turn) sixteen slightly oblique rounded ribs, faintly evident across the band and anteriorly extending to the suture, or, on the last whorl, well forward on the canal ; these are crossed by (on the smaller whorls) two to four or (on the last one) sixteen rounded threads, distinct in the interspaces and slightly swollen on the tops of the ribs where they cross ; half of those on the last whorl are in its anterior third, being as usual more crowded on the canal ; the lines of growth are but slightly visible, and there are only faint indications of spiral striæ ; in addition to this the entire surface is covered with most minute punctations, visible only under a strong magnifier ; notch in the adult very deep, with its edges raised and directed backward, the outer lip produced forward and inward so much as to cover the entire aperture when the shell is held so that the bottom of the notch is kept in view ; the outer lip is thickened, and with four to eight small denticulations rising from its surface a short distance within its margin ; pillar straight, somewhat thickened ; a slight callus on the body whorl ; canal very slightly recurved ; one adult has an ashy and another an olive tinge, but a fresh specimen is quite white. Lon. of shell, 13.0 ; of last whorl, 8.0 ; of aperture, 5.25. Max. lat. 5.25 mm. Defl. about 27°.

Bed of the Gulf Stream, Pourtalès, 447 fms. Station 19, 310 fms. Station 43, 339 fms. Sigsbee, off Havana, 450 fms. Station 2, 805 fms.

P. (Drillia) detecta n. s.

Shell having a strong superficial resemblance to the last, but with a totally different nucleus, and with differences in details of sculpture ; it also has not the minute punctation ; color white or ashy gray ; nucleus and nuclear whorls heliciform, with a sculpture of slightly raised lamellæ waved backward from the middle point of the periphery both ways ; under these are also fine revolving raised lines ; whorls in all nine ; remainder with a transverse sculpture of from sixteen to (on the last whorl) eighteen narrow raised riblets passing entirely over the whorls, quite faint on the band and only obsolete on the columella and canal ; beside these the lines of growth are unusually distinct, somewhat raised and rounded, and are especially well marked on the notch-band ; revolving sculpture consisting of three or four (on the last whorl thirteen) raised rounded threads slightly swollen where they cross the transverse riblets ; between these are usually two, but sometimes as many as four, similar but finer threads, which also invade the band and cover the pillar, but cross the riblets without enlarging ; the interspaces between the ribs are less deep, and the whole sculpture more uniform and less prominent than in the last species ; suture appressed ; band less prominent than in the last ; notch shallow, pillar nearly straight, canal very slightly recurved ; outer lip (not adult) thin. Lon. of shell, 11.75 ; of last whorl, 6.75 ; of aperture, 4.5. Max. lat. 4.5 mm. Defl. about 27°.

Station 43, 339 fms.

In the absence of any perfectly mature specimen it is impossible to say what the mouth characters would be, but it seems likely that they would resemble the last species from the general similarity of the juvenile portion.

P. (Drillia) serga n. s.

Shell small, dull, slender, yellowish white, eight-whorled ; nucleus small, translucent, shining, passing into the sculpture of the adult gradually, in two and a half nuclear whorls, which show first minute transverse wrinkles on the periphery of the second whorl ; succeeding whorls transversely sculptured by eight to twelve slightly oblique angular riblets, which pass entirely over the whorls, and only become obsolete on the canal ; these are crossed, first by (on the upper whorls) two or (on the last whorl) nine rounded threads which rise to sharp points on reaching the summits of the riblets, and are perfectly distinct in the interspaces ; secondly, by finer intercalary revolving threads, which pass without change over the riblets, usually to the number of three or four between each pair of primary threads ; these also cover the notch-band, and over them, as well as the primaries, the lines of growth are raised in microscopic granules, or lamellæ, which, under strong magnification, give a very peculiar scabrous appearance to the surface ; the strongest primary riblet is the one just in advance of the somewhat steeply declining and poorly defined notch-band ; aperture narrow, notch deep, outer lip thin, produced, probably thickened in the perfectly mature adult ; columella and body whorl without callus ; pillar straight ; suture appressed ; canal slightly recurved. Lon. of shell, 9.0 ; of last whorl, 5.25 ; of aperture, 4.12. Max. lat. 3.25 mm. Defl. about 28°.

Bed of the Gulf Stream, Pourtalès, 447 fms.

This much resembles, on a cursory glance, the two preceding species, while a careful microscopic scrutiny shows very marked differences.

P. (Drillia) smirna n. s.

Shell long, slender, shining with the lustre of barley-sugar candy ; whorls twelve, of which two are nuclear ; nucleus white, smooth, rather large, inflated, polished, not sculptured except by lines of growth, changing suddenly into the normal sculpture ; sculpture consisting of small pointed nodules set on the periphery of the whorls, a little in advance of midway between the sutures, ten to fourteen on each whorl, except the last half-whorl in the adult, where they begin to be obsolete ; the tips of these nodules and a line just in advance of the suture are white as compared with the general translucent pinkish or fleshy hue ; these nodules are a little compressed in the latter whorls in a direction transverse to the whorls ; the lines of growth are distinct and in the later whorls occasionally a little prominent at the suture, against which the shell is appressed ; other transverse sculpture none ; revolving sculpture comprised in fifteen or twenty threads on the last whorl, faintly visible at the periphery and gradually becoming stronger toward the end of the canal ; an occasional trace of such might be visible on some of the older whorls ; notch moderately deep ; notch-band not strongly marked ; outer lip in the adult produced (but imperfect in our specimens), apparently having the usual form ; pillar obliquely cut off anteriorly, covered with a light callus ; canal narrow ; aperture short and seemingly rather wide, behind. Lon. of shell, 15.0 ; of last whorl, 5.75 ; of aperture, 4.0. Max. lat. of shell, 3.25 ; of aperture, about 1.5 mm. Defl. about 16°.

Off Cape San Antonio, 413 fms.

An elegant, remarkable, and characteristic species.

P. (Drillia) oleacina n. s.

Shell in sculpture much resembling the last, especially on the older whorls which differ from those of *D. smirna* in the following particulars : the nucleus is a rich, dark, shining brown ; the nodules have more extended bases, and want the white tips ; the color of the whorls is more clearly translucent, wanting the pinkish tinge and the white sutural line ; the whorls increase more rapidly in size, and are strongly appressed against their predecessors, thus making the line of the suture irregular; whorls nine instead of twelve; the body whorl is quite different in shape and sculpture; the nodules, of which there are on the last whorl only eleven instead of fourteen, instead of becoming obsolete on the latter half of the whorl, are produced in the form of stout, strong ribs over the periphery, when these suddenly cease and the anterior part of the whorl is as it were constricted, instead of gradually tapering to the canal, so that the latter is much more clearly differentiated from the rest of the aperture than is usual in this genus; there is no spiral sculpture, even on the canal where traces are usually perceptible; notch as usual; a thin callus on the pillar rising into a sort of lamina at its outer edge forms a rather deep groove along the columella, which last is attenuated anteriorly. Lon. of shell, 10.0; of last whorl, 5.0; of aperture, 3.75; of canal, 1.5. Max. lat. of shell, 3.0; of aperture, 1.5 mm. Defl. about 22°.

Station 21, 287 fms.

Belonging to the same group as the last, but sufficiently distinguished from it.

P. (Drillia) Havanensis n. s.

Shell somewhat variable, small, white, the first six whorls rather slender, giving a subcylindrical apprarance, the latter whorls, if any, enlarging more rapidly; whorls about eight, of which about two are nuclear; nucleus large, white, smooth, unsculptured, forming for the shell a rather blunt button-like apex; succeeding whorls marked by a transverse sculpture of twelve to (on the last turn) eighteen narrow, oblique, flexuous ribs, which begin as little sharp nodules at the suture, are evanescent over the notch-band, thence continue to the next suture, or in the last whorl become evanescent at its anterior third; these ribs are crossed by a variable number of rather sharp revolving threads, with wider interspaces, usually three or four in number (on the older whorls) to sixteen (on the last whorl), beginning just in advance of the band; the first two are most prominent, and angulate the riblets where they cross them, producing little raised points; the succeeding threads are a little enlarged where they cross the ribs, but do not form points, and are as usual closer together on the anterior part of the canal; on the band is no sculpture except the lines of growth and an occasional faint indication of revolving striæ; the number of riblets and of threads with their respective sharpness and the prominence of the nodules are somewhat variable; the band is somewhat excavated, tending to give a turreted appearance in old shells; notch broad, not deep; outer lip thin, produced forward; pillar straight, anteriorly attenuated, with very little callus; lines of growth well marked all over the shell. Lon. of shell, 9.0; of last whorl, 5.0; of aperture, 3.75. Max. lat. of shell, 2.5 to 3.0; of aperture, 1.0 mm. Defl. 24° to 27°.

Station 16, 262 fms. Station 19, 310 fms. Sigsbee, off Havana, 450 fms. Yucatan Strait, 640 fms.

The specimen measured was the largest, and that which had the greatest apical angle ; the alternative measurements are from an adult, but more slender specimen. Considering the number obtained, the variability was perhaps not greater than might have been expected.

P. (Drillia) Verrillii n. s.

Shell resembling *D. oleacina* on a very small scale ; white, with a large white, smooth, inflated nucleus ; whorls six or seven, rounded, polished, translucent waxen whitish ; transversely sculptured by twelve to fourteen rounded, stout, strongly raised ribs extending forward from the notch-band to the suture, or on the last whorl to its anterior third ; on the last half of the last turn evanescent ; suture appressed ; lines of growth evident ; spiral sculpture, none visible ; a decided callus with a groove behind it on the pillar and body whorl ; notch, as usual in the adult, rather deep ; aperture rather wide behind, and shaped as in *D. oleacina.* Lon. of shell, 5.5 ; of last whorl, 3.0 ; of aperture, 2.0. Max. lat. of aperture, 1.0 ; of shell, 1.75 mm.

Station 19, 310 fms.

This pretty little species seems quite distinct from any of the others, and unlike any of the known Northern forms. This and the three previously described species form a little group similar in general character, yet distinct in detail, but requiring close and careful inspection.

P. (Drillia) peripla n. s.

Shell small, rough, dark-colored (normally ?), acute, nine-whorled ; nucleus and two and a half nuclear whorls yellowish, with sculpture reticulated by raised revolving lines, and lines waved backward from before and behind a point on the periphery ;* remainder of the shell transversely sculptured by twelve or (on the last whorl) fourteen rounded ribs, which start at the anterior border of the band, where they are roundly shouldered, and continue somewhat obliquely to the suture, or, on the last whorl, to the anterior third, narrowing as they go ; beside these, the lines of growth are well exhibited and the notch-band is ornamented by distinctly raised, transverse, backwardly concave plications, which extend across it, about nine in the space of a millimeter, with wider interspaces ; spiral sculpture consisting of (on the smaller whorls) three to (on the last whorl) about nine raised rounded riblets, the first of which is just in advance of the band, and between every pair of which are two (or in rare cases) three much finer threads ; the primary threads are a little swollen where they cross the transverse riblets, the secondary threads not so ; toward the anterior end of the canal the threads become uniform in size and are crowded together ; the threads, especially the secondary ones, have a rough appearance, perhaps due to the lines of growth ; aperture (excluding the canal) ovate, somewhat abruptly compressed to form the very distinct straight canal ; pillar straight, without callus ; outer lip imperfect in the specimen, but probably thickened in the adult. Lon. of shell, 8.0 ; of last whorl, 4.75 ; of aperture and canal, 3.5. Max. lat. of shell, 3.25 ; of aperture, 1.5 mm. Defl. about 34°.

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* This peculiar sculpture of the nuclear whorls is noted by Verrill in one of his *Pleurotomellæ,* and has been described several times in this paper. It was described and figured as a mature form by D'Orbigny under the name of *Sinusigera.* Cf. Sagra, Moll. Cuba, Atlas, Pl. XXIII. figs. 7–9.

Yucatan Strait, 640 fms.

The specimen is light brown, blotched with a darker shade, but it is doubtful if this is not accidental to the specimen. The abrupt contraction to form the canal gives it the aspect of a little *Fusus.*

P. (Drillia) elusiva n. s.

Shell small, rather acute, having a dull, ashy, worn appearance, the sculpture faint, as if obsolete, although quite perfectly preserved, whorls eight or nine; nucleus, nuclear whorls, and sculpture of the notch-band precisely as in the last species ; spiral sculpture much the same, excepting that there are from three to six secondaries between the primary threads, and all, both secondaries and primaries, are ill defined and barely elevated above the surface ; on the smaller whorls there are eight or ten transverse swellings extending from the edge of the notch-band to the suture, too wide and ill defined to call ribs, and chiefly evident as oblique waves most prominent at the anterior edge of the band ; on the last whorl barely evident as ten or twelve faint nodules just before the band and wholly obsolete before the periphery ; form of the whorls wholly different from that seen in the last species, the whorl and aperture tapering imperceptibly into the short canal, with about seven spiral threads distinguishable as larger than the secondaries ; notch moderate; suture appressed, indistinct ; outer lip thin, simple, moderately produced forward in the middle ; pillar short, twisted, with a thin white glaze on it ; canal distinctly recurved. Lon. of shell, 9.25 ; of last whorl, 5.25 ; of aperture, 4.0. Max. lat. of shell. 3.75 ; of aperture, 1.5 mm. Defl. about 35°.

Yucatan Strait, 640 fms.

A species with no salient characters or attractions, which a sufficiently large series might perhaps show to be an extreme variety of *D. peripla.*

P. (Drillia) morra n. s.

Shell small, acute, with the *Sinusigera* nucleus, and seven or eight reticulated whorls ; sculpture, on the earlier whorls, of ten or twelve, and, on the last whorl, of twenty-five equal, rounded, close-set riblets, beginning at the anterior edge of the band, growing stronger and wider to the periphery, after which they again diminish, covering the whorls, and on the last visible nearly to the extreme of the canal ; these are crossed by (on the fourth whorl) four, or (on the last) about twenty-five close-set rounded threads, with a tendency to form a little nodule where they cross the summit of the transverse ribs, and pretty even in size; the first one forms a smooth margin to the narrow, but well-defined notch-band, which is crossed by the lines of growth deeply waved, and extends to the suture, which is not appressed; outer lip thin, much produced forward, as in *Daphnella*, but the notch is distinct and very deep, with its edges simple and not reflected; pillar slightly twisted, without a callus; canal distinct, slightly recurved; whorls full and rounded. Lon. of shell, 5.75; of last whorl, 3.5; of aperture, 2.5. Max. lat of shell, 2.5; of aperture, 1.0 mm. Defl. about 37°.

Sigsbee, off Havana, 450 fms.

This little shell has quite the *Daphnella* shape, but the nucleus, the notch, and its band seem to decide that it should go with the Drillias, until more is known.

P. (Daphnella?) leucophlegma n. s.

Shell thin, delicate, pearly white, acute, with nine rapidly enlarging whorls, roundly inflated (especially the last), which gives a turreted appearance to the spire; nucleus minute, glassy, smooth, simple; nuclear whorls not separated by any sudden change of character from the rest of the shell; general sculpture consisting of numerous close-set (three or four to a millimeter) narrow plications extending from near the suture obliquely and flexuously across the whorls, in general correspondence with the lines of growth; on the last whorl fading away anteriorly and barely visible at the periphery; lines of growth generally pretty distinct; the whole shell covered with fine, somewhat wavy, spiral grooves and intervening threads, not strong enough to give a rough appearance to the surface, and evenly distributed (twelve to sixteen in a millimeter); aperture large, semilunate; outer lip thin, simple, much arched and produced at the middle, and rounding broadly to the anterior end of the pillar; columella with a slight callus, obliquely trimmed to a point, and slightly recurved anteriorly; notch obsolete, forming no distinct band, though indicated by the lines of growth and by a slight flattening of the whorl just in front of the distinct and well-marked suture, as in *Daphnella*. Lon. of shell, 10.25; of last whorl, 6.25; of aperture, 4.75. Max. lat. of shell, 4.25; of aperture, 2.0 mm. Defl. about 36°.

Station 2, 805 fms.

This pretty little shell may turn out to be a *Drillia*. It has characters recalling *Daphnella*, *Bela*, and (the immature) *Drillia*. Until the soft parts are known it can hardly be definitely located.

Taranis Mörchii Malm.

T. Mörchii Malm, Sars, Moll. Reg. Arct. Norv., p. 220, tab. 17, fig. 8. 1878.

Station 2, 805 fms.

This specimen resembles Sars's figure exactly, except that it has one whorl more, and is correspondingly larger. I observe, however, that the specimens sent as *T. mörchii* from Norway to me by Prof. Sars and Dr. Jeffreys agree better with Verrill's description of his *Taranis bella* than they do with the figure above cited. It is not improbable that the species is pretty variable, and that trifling variations in sculpture may not indicate specific differences.

Trichotropis migrans n. s.

Shell white, solid, rough, with six rapidly enlarging whorls; upper whorls rounded, last whorl with a tendency to applanation on the basal side; epidermis lost; spiral sculpture of (on the fourth whorl) five to (on the last whorl) twenty revolving ridges, which cross (on the fourth whorl) twelve to (on the last) ten varix-like ribs or costæ, extending completely around the whorl; these increase by dichotomy and between the costæ are quite uniform, widening as they reach the crest of a varix and then suddenly diminishing in breadth to repeat the process at the next one; between the spiral ridges the interspaces are channelled, and rarely contain a single a fine thread; beside the costæ the whorls are crossed by beautifully fine and even raised liræ, corresponding in direction to the lines of growth, and only visible under a magnifier; aperture rounded, produced into the narrow canal in front; pillar with a thin lamellar callus (behind which is a narrow umbilical chink) and a slight toothlike projection on the inner side; interior of aperture shining, smooth. Lon. of shell, 9.25; of last whorl, 6.0; of aperture, 4.0. Lat. of shell, 6.0; of aperture, 3.5 mm. Defl. 54°.

Sigsbee, near Havana, 80 fms.

The first of the genus from tropical waters.

Marginella Watsoni n. s.

Shell short, stout, white or yellowish white, polished, five-whorled; suture marked under the glaze with a darker translucent line; apex obtuse; in adults the nucleus is obscured by the glaze, in young specimens it presents no differences from the rest of the shell; last whorl shouldered roundly, forming a rounded angle at the posterior part of the outer lip; aperture narrow, labrum and labium nearly parallel; pillar with four clearly cut folds, the anterior continued around the margin of the canal, slightly flaring, to join the outer lip; the latter slightly thickened inside, with about a dozen rounded denticulations, outwardly little or not at all reflected, joining the body behind at an acute angle. Lon. of shell, 9.5; of last whorl, 8.0; of aperture, 7.50. Lat. of shell, 6.0; of aperture, 1.5 mm.

Sigsbee, off Havana, 480 fms.; Station 2, 805 fms. Bed of the Gulf Stream, Pourtalès, 447 fms.; Yucatan Strait, 640 fms.

This species resembles *M. vitrea* Hinds, from West Africa, in general shape, but that species is smaller and has the outer lip not denticulated. *M. Watsoni* has the facies of a deep water shell, and does not appear to agree exactly with any I find figured.

Marginella fusina n. s.

Shell ovate-fusiform, with the spire nearly as long as the aperture, polished waxen white, five-whorled; whorls of the spire well marked and rotundate though covered with a transparent glaze; suture distinct; apex rounded; lines of growth perceptible under the glaze, especially near the suture on the last whorl; aperture short, lunate, with no posterior angle in the outer lip, which gently rounds to the body whorl before and behind; outer lip a little thickened inside, simple, not reflected; folds four, the two anterior ones very oblique and close together; canal not flaring, short, and not twisted backward. Lon. of shell, 8.0; of last whorl, 6.0; of aperture, 4.5. Max. lat. 4.0; lat. of aperture, 1.5 mm.

Yucatan Strait, 640 fms.

This has somewhat the shape of *Marginella nodata* in a general way, but is more evenly fusiform, and quite peculiar in its even taper, which does not seem to be ascribed to any other species.

Marginella seminula n. s.

This species differs from the last by its proportionally shorter spire containing one less whorl; by the less distinctly marked suture; by the shouldering of the last whorl which angulates the outer lip in adult specimens, the lip in this vicinity being generally much thickened and slightly reflected, somewhat produced in the middle, and thinning toward the distinctly flaring canal; the columellar folds are more evenly separated, and the canal is slightly recurved. In other respects it resembles *M. fusina*. Lon. of shell, 7.0; of last whorl, 5.62; of aperture, 5.12. Lat. of shell, 3.5; of aperture, 1.25 mm.

Yucatan Strait, 640 fms.

There is some variation in size and in the way in which the outer lip is thickened in different individuals. The shape is not far from that of *M. festiva*. The measurements are of the largest of several specimens.

M. (var.?) Yucatecana.

Shell with three and a half to four whorls, smaller than the last and the adult specimens proportionally more slender and of a distinctly different shape; but some of the younger specimens of *M. seminula*, before they have put on the lip-callus and its angulation, appear much more similar, and suggest that the range of variation may be wide enough to cover both. The present form, with a proportionately shorter spire and longer and wider aperture, has an evenly rounded outer lip and body whorl, which recalls *M. fusina*. Its chief differences from *M. seminula* consist in those features which accompany the shouldering of the whorls and the thickening of the outer lip, which in this form seems to be always evenly rounded, arched forward, and hardly thickened ; it is slightly but distinctly reflected, and the canal is slightly recurved. Lon. of shell, 5.62 ; of last whorl, 5.0; of aperture, 4.0. Lat. of shell, 3.0 ; of aperture, 1.37 mm.

Yucatan Strait, 640 fms.

Marginella torticula n. s.

Shell slender, shining, grayish waxen white, of about five whorls ; spire roundly pointed, slender, covered in the adult with a complete coat of translucent glaze almost obscuring the sutures ; last whorl somewhat appressed between the junction of the outer lip and the suture ; turns somewhat laxly coiled ; surface perfectly smooth ; axis laterally curved, with the convexity to the left, so that the spire and the canal both point to the right of a straight line when the shell is in its natural position ; aperture long and narrow; columella with four very oblique folds, of which the one behind the anterior fold is a little the most prominent ; outer lip simple, not reflected, slightly thickened, and produced posteriorly, inwardly convex and externally concave in correspondence with the bent axis ; aperture widest anteriorly, making the canal very open ; no callus on the body whorl, which is joined by the outer lip at an exceedingly acute angle. Lon. of shell, 11.5 ; of last whorl, 9.75; of aperture, 8.0. Max. lat. of shell, 3.75 ; medium lat. of aperture, 1.0 mm.

Station 5, Lat. 24° 15′, Lon. 76° 49′.5, in 229 and 152 fms., soft coral ooze.

The only shells normally arcuated in this manner which occur to me are some species of *Eulima*. The twist gives the shell a very peculiar and highly characteristic appearance.

Marginella (avena Val. var.?) **avenella.**

Shell exceedingly variable in proportions ; spire short, obtuse, sometimes almost suppressed ; color light yellow or yellowish white, with a faint white line bordering the suture ; general cutline elongated ovate ; aperture long, narrow behind (where the outer lip is thickened and a little inflected), wider in front (where it is thin) and a little flaring at its (widest) anterior termination ; columella with four subequal folds, all rather oblique ; outer lip simple, thickened behind, where the line of callus may extend to the suture or fall considerably short of it ; slightly concave in the middle, where its edge is even turned in a little ; scarcely, if at all, produced forward ; whorls not at all or very slightly shouldered, three or four in number. In the form with the short rounded spire, the outer lip is straight, not inflected, and more evenly thickened along its whole length ; the anterior end of the aperture has the outer lip obliquely cut off, and not flaring; the whole form is more evenly ovate-cylindrical. The measurements of the long and short spired specimens are respectively as follows : — Lon. of shell, 12.0 and 9.5 ; of last whorl, 10.25 and 9.0; of aperture, 9.5 and 8.25. Max. lat. of shell, 5.0 and 3.75; lat. of aperture at middle part, 1.0 and 1.0 mm.

Station 2, 805 fms. Off Cape San Antonio, 1,002 fms. Station 5, 229 and 152 fms.

Notwithstanding the differences above indicated by extreme specimens, the shells appear to grade into one another and to approach very closely the old *M. avena* of Valenciennes, of which indeed this may be but an abyssal race; but of the latter I have no typical specimens, and it is described as having color bands. In view of the great number of the closely allied forms of this group, without such specimens it would be rash to consolidate.

Another form with the spire almost lost (from Yucatan Strait, 640 fms., and Station 2, 805 fms), of a yellowish white tinge, strongly resembles D'Orbigny's *M. triplicata*, which I take to have been founded on an abnormal specimen, and might be thought a pale race of *Volvarina varia*, but I am not at all sure that it is not an extreme form of the preceding. The genus *Volvarina*, unless supported by other than its conchological characters, must be given up, if the above inferences be supported by further investigation.

GENUS PUNCTURELLA Lowe.

Type **Patella noachina** L.

= *Patella* sp. L., Mantissa, p. 551, 1771; O. Fabr., Faun. Grönl., p. 384, 1780; etc.
< *Cemoria* Leach, MS., 1819; Lowe, Zoöl. Journ., III. p. 77, *passim*, 1827.
not *Diodora* Gray, Lond. Med. Rep., XV. p. 233, Mar., 1821 (no diagn.). (= *Fissurella* sp. juv.)
not *Cemoria* Risso, Hist., IV. p. 258, 1826. (= *Calyptræa* Lam.)
= *Diadora* "Gray," Blainville, Man., I. p. 501, *passim* (in error), 1825 (no diag.).
= *Puncturella* Lowe, Zoöl. Journ., III. p. 78, Jan., 1827 (*P. noachina*).
< *Sipho* Brown, Ill. Conch. Gt. Brit. (ed. prima), pl. 36, fig. 14–16, 1827 (*S. striatus* Br. = *P. noachina* Lowe). Id. Conch. Textb., 1833, p. 100, sole ex. *S. striatus*, Pl. XIV. fig. 21; do. (ed. Macgillivray n. d.), ed. VI. p. 115, Pl. XIV. fig. 21, same type. (Not *Sipho*, Klein, Fabr., nor Mörch.)
Fissurella sp. Lyell, Phil. Trans., 1835, p. 37; and most older authors.
Diodora Gray, Syn. Brit. Mus., 1840, name only.
Rimula sp. Couthouy, Bost. Journ. Nat. Hist., II. p. 87, 1838; Lovén, Ind. Moll. Scand., p. 21, 1846. (Not of Defrance.)
= *Cemoria* Möller, Index, p. 16, 1842; Migh. & Ad., Bost. Journ. Nat. Hist., 1842, p. 42; Gray, Ann. Nat. Hist., XX., 1847 (name only).
? *Siphon* "Brown, 1844," Gray, P. Z. S., 1847, p. 147 (not of Brown).
< *Sypho* "Brown, 1827" Gray, P. Z. S., 1847, p. 147; Philippi, Handb., p. 217, 1853; Forbes & Hanley, Brit. Moll., II. p. 473, 1853. (Not of Brown.)
< *Cemoria* Leach, Moll. Gt. Brit., p. 213, Dec., 1852. (Here for the first time published according to the rules of nomenclature.)
= *Puncturella* (Lowe) Forbes & Hanley, Brit. Moll., II. p. 473, 1853; Woodward, Man. Moll., p. 150, 1853; Gray, Guide Brit. Mus., p. 164, Jan., 1857; Jeffreys, Brit. Conch., III. 256, 1865.
= *Cemoria* H. & A. Adams, Gen. Rec. Moll., I. p. 450, 1854; Chenu, Man. Conchyl., I. p. 372, 1859.

About 1819 the young shell of *Fissurella græca,* which had been described as a separate species (*Patella fissura*) by Montague, attracted the attention of Messrs. Brown, Leach, and Gray, on account of the spiral apex, which disappears in the adult, a fact not recognized by them. Brown claims to have first pointed this out to Leach, and to have proposed to call the shell by the new generic name of *Sipho,* which he published in the latter part of 1827 in his Illustrated Conchology of Great Britain. He complains that his name was not adopted, and that Dr. Leach preferred to name the shell *Cemoria.* Meanwhile it would appear that Dr. Leach's intimate friend and pupil, Mr. J. E. Gray, was unaware of the proposed name of Dr. Leach, since in 1821, without a description, he suggested for the shell in question the name of *Diodora.* Blainville erroneously supposed Gray's sole species to be *Patella noachina* of Linnæus, and so refers to it in a note without adopting or describing it. To his original *Cemoria* Dr. Leach afterward added a shell, which he received from Fleming, under the name of *C. flemingianus* as a second species, but of neither was any publication made. In 1827 Lowe properly defined and published his genus *Puncturella,* stating that he believed it to have formed one of Leach's unpublished species of *Cemoria.* The name *Cemoria* was used by several authors without any description subsequent to Lowe's publication, but was only published by Dr. Gray from the manuscripts and unpublished plates of Leach, in December, 1852. If unpublished and undescribed names are to have any place in nomenclature the name *Diadora* from Blainville's erroneous reference has the first claim. But since this is properly forbidden by the rules of nomenclature, the only name having any just claim to priority is that of Lowe, which has accordingly been adopted by the best authorities. Believing that the introduction of unpublished names leads only into the limbo of inextricable confusion, I have no hesitation in following the example of the eminent authors of the British Mollusca, and adopting the name *Puncturella.*

Puncturella circularis n. s.

Shell white, acutely conical, with the anterior wall slightly, and the posterior wall strongly concave ; tip sharply recurved, acute, not spiral, directed backward in the middle line ; surface ornamented with about forty very slender radiating lines, fewer toward the apex with intercalary threads toward the margin ; concentric sculpture consisting of extremely delicate, irregularly disposed aggregations of the lines of growth, which now rise above and now fall below the general plane of the surface, giving it under a strong magnifier a curiously malleated appearance, between the radiating threads, nowhere exhibiting any uniform concentricity ; where the lines of growth cross the radiating threads they form fine overlapping scales closely appressed to the threads ; puncture ovate, pointed behind ; margin thickened, perfectly smooth ; septum triangular, inclined forward under the puncture which it almost entirely hides when viewed from below ; basal edge subcircular. Lon. 5.75 ; lat. 5.0 ; alt. 3.0 mm.

Station 44, 539 fms.

This species differs in various details from *Puncturella profundi* Jeffreys, and is apparently nearer his *P. granulosa* from the Norwegian coast and the Porcupine Expedition (60 – 292 fathoms). That species has no concentric sculpture, however, and has not been fully described as far as is known to me. It belongs, with the preceding and with *Puncturella Cooperi* Carpenter, from the northwest coast of America, in the genus *Fissurisepta* of Seguenza. This differs in most specimens by having no props to the septum, a character, however, which is not constant even in the same species, as in a large series of Alaskan forms I have found every transition from fully developed props to none at all, in specimens which differed in no other character. Hence, while it may be a permanent feature in some species, I doubt if it is yet sufficiently established to be safely used as a generic character.

Puncturella trifolium n. s.

Shell brownish white, acutely conical, with anterior and posterior walls nearly straight, except near the tip where they are slightly concave, especially the latter ; tip erect, squarely truncated at the top, not twisted, inclined, or recurved ; surface ornamented with some twenty-four to thirty strongly elevated rounded ribs, smooth for the most part, but undulating a little as they pass over the concentric sculpture and rarely and irregularly spinous ; these spines do not exceed two or three on any rib, occur only on the stronger ribs and are short, pointed, solid, and acutely triangular ; between the primary radiating ribs are secondary ones about equal in number, but not spinous, and not raised above the concentric sculpture ; the latter is not strictly concentric except in a general sense, and consists of stout spongy bands connecting the ribs, passing from base to base between each pair of primary ribs on a level with the secondaries, but not evenly continuous clear around the shell, and having a pumice-like texture, so that the bands are not defined sharply like the ribs ; the spaces left vacant by this reticulation are rather deep, and have a worm-eaten appearance ; shell inside smooth, with shallow grooves indicating the stronger external ribs and with a striated space over the head between the anterior horns of the scar of the great pedal muscles. Puncture externally circular, as in *Glyphis*, internally trefoil-shaped from the projection of the middle of the septum and two little shelly knobs on each side into the space ; septum triangular, very small and short, inclined in about the same plane as the anterior wall of the shell, in the middle of its lower edge produced and thickened like a little short tongue ; about half-way between the base of the septum and the outer upper surface of the perforation inside the tube and at about equal distances from each other and from the median line of the septum, are two little shelly triangular projections, which give to the interior of the apex, when looked through, the trilobate outline referred to in the specific name ; base of the shell ovate, the margin showing projections and indentations corresponding to the sculpture of the exterior. Lon. 14.0 ; lat. 10.5 ; alt. 7.0 mm.

Yucatan Strait, 640 fms.

The peculiarities of the apical tube are quite as great in this species as in the preceding when compared with typical *Puncturella;* but I cannot consider them as of even sectional importance. It is hardly necessary to add that the species does not resemble any of the ordinary forms, nor has it, so far as I am able to determine at present, beën anywhere previously described.

Emarginula Rollandi Fischer.

Sigsbee, off Havana, 450 fms. Station 21, 287 fms.

Emarginula sp. indet.

Yucatan Strait, 640 fms.

FAM. PLEUROTOMARIIDÆ Dall.

> *Pleurotomariæ* Swainson, Mal., pp. 213, 223, 363; as subfamily of *Trochidæ;* 1840.
>< *Pleurotomariidæ* Chenu, Man., I. p. 236, 1862. In suborder *Proboscidifera* near *Scalariidæ.*
> *Pleurotomariidæ* Bronn, Keferstein Thierreichs, Mal., III. 1037, 1866.
> *Pleurotomariidæ* Stoliczka, Pal. Indica, Gasterop., p. 380, 1868.
? *Pleurotomariidæ* Gill, Fam. of Moll., p. 11, No. 132, 1871. (Limits not stated.)

Shell trochoid in form, internally pearly, the last whorl perforated or fissured, for the escape of eggs or fecal matters, in the direction of the coil of the whorl.

Operculum horny, subspiral or multispiral.

Branchiæ two, nearly symmetrical, one on each side of the slit in the mantle corresponding to the fissure or perforations of the shell.

Animal with papillose edge to the mantle and lateral fringes; without elongated cirri as in the Trochids; with no frontal veil, or fissuring of the foot. Muzzle simple, without a proboscis, eyes on pedicels exterior to the bases of the simple tentacles. Jaws small, weak.

Dentition. Rachidian tooth small, lanceolate or broad bayonet-shaped, laterals rather simple, numerous, similar, diminishing in size outwardly, followed by a large number of long slender uncini, many of which are denticulate near their tips and also furnished with a little tuft of bristles or a brushlike bunch of fibres attached to the side of each uncinus behind the denticulations, the tips of the fibres projecting beyond the end of the uncinus.*

Distribution. Fossil in Lower and Upper Bala groups, Upper Cambrian of Sedgewick, and thence to recent times; two species living in the Antilles, one of unknown habitat, probably Japanese.

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* More minute details will follow hereafter in an account of the two species obtained.

GENUS PLEUROTOMARIA Sowerby.

Pleurotomeria Sowerby, Min. Conch., III. p. 139, text to pl. 278, Dec., 1821. Type *Trochus Gibbsii* Sby., tab. 278, fig. 1, 2 (= *Tr. ornatus* Sby. fide D'Orbigny). Ed. Agassiz, p. 316, 1842. Characterized, but no mention is made of Defrance or any one else.

"*Pleurotomaria?* Defrance," Férussac, Tabl. Syst. XXXIV., Juin, 1821. Not characterized; no species cited; placed in *Trochidæ*.

Pleurotomaire Defrance, Tabl. des corps. org. foss., 114, 1824. No Latinization, characterization, or species mentioned; placed in *Scalariens*.

Pleurotomarium Blainville, Man. Mal., I. p. 429, 1825. Type *P. tuberculosum* Defr. MS., Tom. II. Pl. LXI. fig. 3, 1827 (Fossil). Described as of Defrance, and type figured. Fischer de Waldheim, Bibl. Paleont., p. 266, 1834.

Pleurotomaria Defrance, Dict. Sci. Nat., XLI. p. 381, 1826, Art. Fossiles; *P. tuberculosa* Defr., first of three species, tab. 86, fig. 3. Characterized here by Defrance for the first time. Also, Dict. Sci. Nat., LV. p. 481, 1828.

> *Pleurotomaria* Rang, Manual, p. 204, 1829; in *Trochoidea* Cuvier.

Pleurotomaria Swainson, Mal., pp. 213, 223, 363, 1840.

Pleurotomaria Gray, Syn. Brit. Mus., p. 89, 1842; in *Haliotidæ*.

Pleurotomaria Philippi, Handb., p. 214, 1853; in *Trochacea*.

Pleurotomaria Woodward, Man. p. 147, *P. anglica*, t. x. f. 24, 1851; in *Haliotidæ*.

Pleurotomaria H. & A. Adams, Gen. Rec. Moll., II., App., p. 630, 1858; in *Stomatellinæ*, subfamily of *Trochidæ*.

Pleurotomaria Chenu, Man. de Conchyl., I. p. 236, 1862; in *Pectinibranchiata* between *Toxifera* and *Scalariidæ* of the *Proboscidifera*.

> *Pleurotomaria* Ryckholt, Journ. de Conchyl., VIII. p. 183, 1860; in *Haliotidæ*. Stoliczka, Pal. Indica, Gast., p. 380, Oct., 1868. Deslongschamps, Bull. Soc. Lin. de Normandie, IX. p. 422, 1865.

This genus was figured by Ulysses Aldrovandus (Mus. Metall., pl. 16) in 1648, and by Lister (An. Angl., p. 214) in 1678, both being, of course, fossil forms. It seems to have been overlooked until now that we are indebted to Sowerby for its characterization, and that he is entitled to be cited as authority for the genus.

Pleurotomaria Quoyana Fischer & Bernhardi.

P. Quoyana F. & B., Journ. de Conchyl., V. p. 165, Pl. V. figs. 1–3, Nov., 1856.

Station 240, 73 fms.; Station 296, 84 fms.; off Barbados. Fischer's specimen was from the island of Marie Galante.

Pleurotomaria Adansoniana Crosse & Fischer.

P. Adansoniana C. & F., Journ. de Conchyl., IX. p. 163, Pl. V. figs. 1, 2, 1861.

Station 278, 69 fms. (dead); Station 276, 94 fms.; Station 291, 200 fms.; all near Barbados.

A description of the soft parts of these species, with figures of the animal taken from life, is in preparation. It is to be regretted that the account will be rendered rather imperfect on account of the poor state in which the soft parts have come to hand. The more delicate portions were entirely destroyed. Those parts of importance in classification, being of a tougher nature, for the most part can be tolerably well made out. Sufficient is already known to show that the group possesses characters of family value, and stands nearest the *Trochidæ*, with features recalling *Haliotidæ;* and that it has nothing whatever in common with the *Pleurotomidæ.*

The other living species is *Pleurotomaria Beyrichii* Hilgendorf (Sitz. Ges. Naturf. Fr., Berlin, Mar. 20, 1877), which is supposed to come from Japan seas, though its habitat is not yet certainly known. Eight specimens altogether of the three species are all at present recorded, only one being known of *P. Beyrichii*, four of *P. Adansoniana*, and three of *P. Quoyana.*

GENUS HALIOTIS Linné.

Haliotis (Padollus) Pourtalesii n. s.

Shell about an inch and a half in diameter, above smoothish except for two strong spiral ribs, the outermost of which was perforated with four or five branchial holes; general form subcircular; color above, rich reddish orange, within brilliantly pearly; whorls about two and a half; spire flattened, not prominent.

Bed of the Gulf Stream in 200 fathoms, near the Florida Reefs, Pourtalès, March 31, 1869.

This species was obtained by the lamented Pourtalès, and carefully examined by me in 1870. It was represented by the only specimen ever obtained from the region, and which was afterward destroyed in the Chicago fire. Its characters are such as to be immediately recognizable if it were again obtained, and it seems proper to associate the name of the discoverer with it, not only as being one of his most notable finds among mollusks, but also as representing a remarkable fact in geographical distribution which might otherwise be lost sight of.

GENUS CREPIDULA Lamarck.

< *Patella* Linné, Syst. Nat., ed. X. p. 781, 1758 ; ed. XII. p. 1257, 1767.

< *Crypta* Humphrey, Mus. Cal., p. 4, Gen. V., May 1, 1797. No description.

= *Crepidula* Lam., Prodr., p. 78, 1799 ; type *Patella fornicata* Lin. (not of Lam., Syst., p. 70, 1801, = *Navicella* Lam.). Roissy, Moll., V. p. 234, 1805. Fischer, Tabl. Synopt. Zoögn., p. 26, 1808. Auctorum.

= *Crepidulus* Montfort, Conch. Syst., II. p. 87, 1810.

= *Proscenula* Perry, Conch., pl. 53, 1811 ; type indeterminable.

= *Sandalium β* Schumacher, Essai d'un Nouv. Syst., p. 184, 1817.

= *Proxenula* Ferussac, Journ. de Phys., t. 90, p. 285, 1820, as of Perry.

> *Crepipatella* Lesson, Voy. de la Coquille, t. II. p. 389 *et seq.*, Atlas, Pl. II. fig. 4 *a*, 1830. Ill. Zoöl., pl. 42, 1831. (*C. Adolphei* Less.). Broderip, Trans. Zoöl. Soc., I. p. 202, 1835, H. & A. Adams, Gen., I. p. 369, 1854.

< *Calyptræa* Broderip, Trans. Zoöl. Soc., I. p. 195, 1835.

> *Crepidipatella* Agassiz, Nom. Zoöl., 1847 ; corr. v. *Crepipatella.*

> *Crepidopatella* Herrmannsen, Ind. Gen. Mal., II. Suppl., p. 38. = *Crepidipatella* Agass. emend. 1852.

> *Lephyrolobus* Schlüter, Syst. Verz., p. 26, 1838 (fide H. & A. Adams).

? *Lepyrolobus* Schlüter, *loc. cit.* Both genus and type undescribed, mere catalogue names. Marschall, Nom. Zoöl., p. 124, 1873.

> *Ianachus* Moerch, Cat. Yoldi, p. 146, 1852 (*I. plana* Say). No description. H. & A. Adams, Gen. Rec. Moll., I. p. 369, 1854.

= *Crypta* H. & A. Adams, Gen. Rec. Moll., I. p. 368, 1854.

?+ *Ergæa* H. & A. Adams, *loc. cit.*, p. 370, 1854 (*E. plana* Ad. & Rve. Voy. Sam.).

= { *Crepidula* Gray, Guide, p. 115, 1857 +
Garnotia Gray, *loc cit.*, p. 117, 1857. (*Crepidula adunca* Sby.)

= *Crepidula* Troschel, Gebiss der Schn., I. p. 159, 1863.

> *Spirocrypta* Gabb, Pal. California, I. p. 136, 1864. (*C. pileum* G., *loc cit.*, pl. 29, fig. 233 *a*, *b*. Cret. Cala.) Subgenus of *Crypta* (Humphr.) Gabb.

This well-marked group has passed through the fluctuations of most well-known genera by being divided into a number of sections which further research has shown to be hardly more than specific modifications, and it would seem as if the time had arrived to concentrate within nearly its original limits the mass of species which have been set apart from one another on merely transitional characters incapable of exact limitation.

Crypta Humphrey was never characterized and has no just claims to recognition under the rules governing zoölogical nomenclature. It moreover appears to have contained representatives of several genera, but no descriptions are given, and his species cannot be positively recognized.

Crepidula protea D'Orbigny.

C. protea D'Orbigny, Sagra, Moll. Cuba, II. 192, Pl. XXIV. figs. 30 – 33.

Specimens which are doubtless the species named as above by D'Orbigny were found attached to dead shells, and even to pieces of coral, from several stations varying in depth from 80 to 450 fms. Also a few small specimens resembling *C.* (*Ianachus*) *plana* Say, but not determinable.

GENUS TRIFORIS Deshayes.

Triforis (Ino) longissimus n. s.

Shell much elongated, sinistral, subcylindrical, yellowish white, polished with more than twenty-two axially flattened, rather obliquely twisted whorls, bearing three spiral rows of small pointed tubercles, fourteen (on the smaller)

August 25, 1881.

to twenty-four (on the terminal) on each whorl; apex wanting, width of shell at fracture 1.75 mm.; transverse sculpture consisting solely of the lines of growth, which, on the last whorl, occasionally rise to the dignity of faint plications; spiral sculpture consisting of the three rows of tubercles above mentioned, of which the anterior is slightly the most prominent and the middle row slightly the most pointed; these tubercles are connected by a slightly raised band, often obsolete and never very distinct, somewhat narrower than the tubercles, and strongest on the last whorl; in addition to these the base of the whorl at its periphery is ornamented by a plain, raised, narrow band, behind which is a rather deep narrow groove, and immediately in front of which is the suture, which would otherwise be hardly visible; about three raised lines separated by shallow grooves are found on the base of the shell toward its outer part, the inner line faintest, and the vicinity of the canal without spiral sculpture; basal surface in the adult flattened before the aperture, rounded behind it, on the whole more rounded than in most species; canal short, slightly recurved, possibly entire in old shells, but in the specimens at hand open in front; sutural aperture large, rounded, with reflected edges, probably finally closed in front; outer lip chipped, but evidently produced and bent in toward the pillar; a slight callus on the body whorl and pillar; aperture roundly obliquely rhomboidal. Lon. of shell (decapitated), 26.0; of first whorl at fracture, 0.75; of last whorl, 4.0; all measured along the axis. Lon. of aperture, 3.0; lat of do., 1.75; of last whorl, 3.25 mm. Defl. about 10°.

This is probably the largest and most elongated species of the group. All the specimens were decapitated, but fresh. The characters do not agree with any of those species described by Hinds, D'Orbigny, or Watson, and are sufficiently well marked when full grown to distinguish it at a glance from any of the other species. In the absence of the tip the flattened whorls give it a tubular aspect.

Triforis turris-thomæ D'Orbigny.

Cerithium turris-thomæ D'Orbigny, Sagra, Moll. Cub., II. p. 155, Atlas, Pl. XXIII. figs. 10–12, 1853.

Station 2, 805 fms., one dead specimen, probably drifted from shoaler water. Reported by D'Orbigny in shell sand from Cuba and Guadaloupe Island.

Triforis bigemma Watson.

Cerithium (*Triforis*) *bigemma* Watson, Journ. Linn. Soc., XV. p. 101, 1880. (Near St. Thomas, W. I., 390 fms.)

Yucatan Strait, 640 fms.

Triforis inflatum Watson.

Cerithium (*Triforis*) *inflatum* Watson, *loc. cit.*, p. 103.

Same localities as the preceding.

Triforis torticulus n. s.

Shell having much the habit of *T. bigemma* Watson, but attaining a much larger size, and devoid of the brown tinge; specimens in hand decapitated, waxen yellowish white, about six-whorls in length, and if perfect, according to the proportions of *T. bigemma*, would probably attain over an inch in length and perhaps eighteen whorls; it is possible that the apex may be blunt, in which case the length and number of whorls might be less; shell very gradually tapering, subcylindrical, sinistral, with rather inflated whorls bevelled towards the suture; longitudinal sculpture consisting, on the posterior surface of the whorls, of four principal spiral ridges continuous, on the later whorls, over the transverse furrows though considerably indented by them, but, on the earlier whorls, entirely cut through by the furrows, and therefore appearing as nodules on the transverse ridges; the anterior spiral ridge forms an exception to this, it is everywhere continuous as a simple thread behind the suture, which is appressed against it; beginning with this, which is the least conspicuous of the four, it is separated from the next posterior spiral by a well-defined gutter; the next spiral is quite close to it, and the third is nearly in the middle of the whorl; the second and third are conspicuously larger than the others and nearly equal in size, the space between them is about equal to their breadth singly; the fourth ridge is smaller and less conspicuous, and the space between it and the third spiral is twice the width of the latter, sloping rather rapidly toward the suture, which is immediately behind the fourth ridge, appressed against the first ridge of the whorl behind; the second and third ridges are sharp on the edge, falling abruptly on the posterior side and rounded toward the basal side, but the fourth is an evenly rounded thread; between this and the third on the later whorls is a very delicate thread, while spiral striæ are visible here and there under a powerful glass; the first ridge forms the periphery of the (in the adult) somewhat flattened base, on which appear, toward the periphery, one or two faint spiral threads or grooves, which in the young are quite pronounced; transverse sculpture consisting of about twenty-seven distinct riblets, separated by about equal furrows, slightly flexuous over the inflated whorls, but in general parallel with the axis of the shell; these are marked by rather prominent parallel lines of growth, which pass over the periphery, and are distinct on the base; columella twisted, slender, slightly thickened; anterior canal slender, small, somewhat produced and bent to the right; aperture rounded, not completely developed in the specimens at hand. Length of four whorls in a nearly adult specimen, 10.5; in a younger one, 6.0. Breadth of the former shell behind, 4.0; in front, 4.2; of the latter shell behind, 2.5; in front, 2.5. Length of last whorl in the first mentioned, 5.0; of aperture, 2.25; width of the same, 1.87 mm.

Yucatan Strait, 640 fms.

This form seems nearest to *T. bigemma* of any described species, but, so far as the specimens in hand go, seems quite sufficiently distinguished from it. When perfect and adult, it must be a very fine example of the genus, and one of the largest known.

Triforis hircus n. s.

Shell elongated, acutely tapered, with fourteen or more rather inflated whorls of translucent whitish color; transverse sculpture of some twenty-one slightly oblique rounded riblets with somewhat narrower interspaces, which are prominent on the periphery of the whorls, and evanescent toward the sutures; these riblets are nearly parallel with the axis in the younger shells, and become more oblique in the adults; each bears two nodules caused by the intersection of the spiral sculpture; beside these there are faint lines of growth, most distinct on the polished and flattened base; spiral sculpture consisting of a thread behind the suture, undulated by the ends of the transverse riblets in the young, simple and regular in the more mature whorls, and forming on the last whorl the margin of the base, and two flattened threads, separated by a wider groove, which rise to nodules where they intersect the transverse sculpture; the distance from the suture forward to the posterior spiral thread is greater than from the anterior thread forward to the next suture, and this wider space has a somewhat excavated appearance, the posterior edge of the whorl being appressed to the suture, and slightly thickened where it meets the post-sutural spiral rib; base flattened, yellowish, polished, with a single faint thread near the periphery; aperture squarish, not completely developed in the specimens accessible; canal very short; pillar twisted, short, stout, of a darker yellow than the rest; apex decollated, probably rather pointed. Lon. of shell, 12.5. Max. lat. 3.0. Lon. of last whorl, 3.0; of aperture, 1.9. Lat. of aperture, 1.75; lat. of first remaining whorl, 0.87 mm.

Yucatan Strait, 640 fms.

This is closest to *T. bigemma*, from which it differs in the less pronounced sculpture, the absence of the first ante-sutural nodulated spiral rib, and the more acute taper of the shell. A large series might show them to be varieties of one species, but in the absence of connecting links they can hardly be properly united.

Triforis cylindrellus n. s.

Shell small, slender, sinistral, whitish, of twelve or fourteen whorls, tapered in the adult both ways, the spire rather acutely (the nucleus is missing), and the last whorl being a little more slender than the two immediately preceding it; transverse sculpture of twenty or more close, faint plications, extending from suture to suture, a little less strong anteriorly, and in the last whorl evanescent in advance of the periphery; the spiral sculpture consisting of L-shaped grooves, one side of which is nearly vertical to the axis of the shell and the other slopes spireward; of these there are three, nearly equidistant, the anterior one, being separated from the suture in front of it by a smooth space, gives to that space the effect of a post-sutural rib; base prominent, inflated, with one faint groove near the periphery, the whole shell showing more or less evident lines of growth, and occasionally faint revolving striæ; whorls inflated, distinct; suture appressed, conspicuous; column twisted, moderately long, stout; anterior and posterior canals developed; outer lip expanded, slightly thickened, aperture rounded. Lon. of shell, 6.5; of last whorl, 1.85; of aperture, 0.75. Max. lat. of shell, 1.5; of last whorl, 1.4 mm.

Cape San Antonio, 640 fms.

Owing to the anterior taper, this species has the aspect of a diminutive *Cylindrella* or *Clausilia*. It belongs to the section *Mastonia* of Hinds.

Triforis (bigemma Watson var.?) abruptus n. s.

Shell short, stout, yellowish white to dark red brown in color, with nine to eleven whorls; sculpture precisely resembling that of *T. bigemma* Watson, from which the shell differs in its shorter, stouter, and more abruptly tapered form; in having about half the number of whorls; in the rounded and sculptured base, upon which are several spiral threads and numerous strong and elevated radiating lines of growth; the anterior canal is very short and not closed in the specimens examined, the posterior canal indicated by a deep wide notch; the outer lip patulous and flaring. Lon. of shell, 7.5; of last whorl, 2.5; of aperture, 1.5. Max. lat. of shell, 2.25; of aperture, 1.25 mm.

Cape San Antonio, 640 fms. Yucatan Straits, 640 fms.

It would seem hardly probable that such an extreme disparity of form and number of whorls, as well as size, should exist in one species; however, since the variability of many of these deep-sea forms in many cases surpasses almost anything recorded from shallow water, I have hesitated to separate this little shell absolutely from Watson's species.

Triforis triserialis n. s.

Shell slender, acute, whitish or yellowish, of about fifteen whorls; nucleus flattened, sharply keeled, white, polished; first nuclear whorl with two keels, on the third an intercalary thread appears, all of which quickly become subequal and uniformly nodulated; sculpture of three spiral rows of tubercles with their anterior (basal) slopes moderate, but the posterior (spireward) slope nearly perpendicular to the axis, so that the tubercles point more or less spireward; the posterior row, just in front of the suture, is a little more prominent than the other two, and so marks the whorls, which are somewhat obliquely coiled; the tubercles are arranged on the whorls obliquely from right to left, and connected by the representative of the nuclear keels, with the spaces between the spirals deep and narrow, that space in which the suture is contained being only distinguishable from the others by the above-mentioned more prominent spiral; the suture itself, even with a good glass, is hardly to be made out; base flattened or in the perfectly mature shell rounded, in the first case with one, in the latter case with three well-marked spiral threads and evident radiating lines of growth; pillar stout, straight, with a thick solid but small lump of callus on it; aperture small and narrow; both canals probably closed, reflected and rather short. Lon. of shell, 8.25 ; of last whorl, 2.0 ; of aperture, 1.0. Max lat. of shell, 1.75 ; of nucleus, 0.5 mm.

Yucatan Strait, 640 fms. Off Cape San Antonio, 640 fms. Station 2, 805 fms.

Without careful study the differences between the forms of this group are hardly noticeable. When examined under a high power it is soon found that species which to the naked eye appear very similar or hardly distinguishable are really characterized by quite a different method in their sculpture, though the general result may be not very dissimilar in its salient features. The tubercles of one are due to grooves cutting transverse riblets; of another, to spiral ridges rising to nodules on the riblets ; of a third, to rows of nodules side by side without spiral or transverse sculpture of any kind. This and the following forms have been separated after several days' close study from an assembly which the first examination had almost decided to place in the category under one specific name. However, there are distinct definable differences between them, and the fact that the microscope is required to perceive these differences should have no effect on our estimate of their systematic value.

Triforis intermedius n. s.

Shell, elongated, slender, acute, yellowish white, of about twenty-three whorls ; nucleus missing in the specimens at hand ; spiral sculpture consisting of two principal rows of rounded tubercles, with spirally confluent bases. which are conspicuous from the beginning to the end of the spire ; if there is any difference in size, the anterior row is slightly the larger ; there are about eighteen of these tubercles on the last turn ; the posterior row lies close to and somewhat appressed upon the suture ; midway between these is a smaller spiral riblet, which rises into narrow elongated waves, or tuberculations, in harmony with the others ; at the base of the whorl is a simple riblet very slightly or not at all waved, and nowhere rising into tubercles ; these spiral series are about equidistant, but the space between the anterior row of tubercles and the basal riblet is more deeply excavated than the others ; base somewhat flattened, conical, with an outer strong spiral ridge and two or three inner fainter ones ; the transverse sculpture consists solely of the lines of growth, which are conspicuous only on the base ; the tubercles, however, are arranged so as to appear as if placed obliquely from right to left across the whorls, so that on the length of the spire the transverse row makes nearly one revolution around the shell ; suture inconspicuous ; pillar short, stout, strongly recurved, with a thick and projecting callus ; anterior and posterior canals open in the specimens examined ; outer lip produced anteriorly, very oblique, forming a narrow aperture ; adult shell with the outline of the spire slightly convex.

Lon. of shell, 11.0 ; of last whorl, 2.25 ; of aperture, 1.5. Max. lat. of shell, 1.75 mm.

Station 2, 805 fms.

This shell somewhat resembles *T. concors* Hinds, from the Straits of Malacca, but the aperture in our species is much narrower, and the shell is of a different color. The base is also of a somewhat different shape. The specimen measured is the most perfect, but not the largest.

Triforis colon n. s.

Shell very slender, elongated, acute, pure white, with a glassy polish when fresh, with twenty-eight or thirty whorls when perfect and complete ; nucleus and first nuclear whorl white, polished, smooth, flattened on top ; surface passing gradually into the second nuclear whorl, with two strong narrow projecting smooth keels, which are then continued into the normal sculpture which they assume very promptly ; the keels project so much that the diameter of the keeled whorl is slightly larger than that of the tubercled third whorl ; spiral sculpture consisting of two rows of round, pointed tubercles and a narrow, flattened band on each edge of the whorl ; the latter occasionally a little waved, but usually smooth, one before and one behind the suture joining so closely that the suture is practically invisible, or appears only under a strong magnifier like a faint groove on the joined surfaces of the (really double, but apparently single) narrow band ; there are sixteen tubercles on the last turn, and those on the anterior row are opposite the interspaces of the posterior row, thus falling into oblique series from right to left across the whorls ; the bases of the tubercles are connected spirally and transversely by small ridges, and the tubercular rows are much more elevated above the general surface than the sutural bands ; there is on the flattened base a single faint thread just within the periphery ; a very young specimen, however, shows several additional inner striæ ; none of the specimens have the mouth in its adult form, consequently, as in immature specimens of this genus generally, the base is flattened, and the canal short and straight, the pillar without callus, and the outer lip simple, thin, and not projecting ; the transverse sculpture additional to the above is solely composed of the lines of growth, which are hardly evident, except on the base ; outline of the spire a very elongated cone, which in old and decollated specimens assumes a subcylindrical form. Lon. of shell, 12.0 ; of last whorl, 1.5 ; of aperture (immature), 0.6. Max. lat. of shell, 1.87 mm.

Sigsbee, off Havana, in 450 fms. Off Cape San Antonio, in 640 and 1002 fathoms.

This species has a sculpture somewhat like *Triforis ruber* Hinds, from New Ireland ; but the tubercles are alternate instead of opposite, and the form and coloration are quite distinct. Indeed, they would fall into different sections according to Hind's classification.

Triforis ibex n. s.

Shell elongated, conical, but less slender than *T. colon*, yellowish white, blunt-tipped, with eighteen or nineteen rather rounded whorls ; nucleus about twice as large as that of *T. colon*, smooth, inflated, rounded on top, larger than the succeeding nuclear whorl, which has two inconspicuous narrow keels which are wavy and almost tuberculate from the first, and pass imperceptibly into the usual sculpture of the shell; spiral sculpture of two rows of somewhat elongated tubercles (about eighteen to the last turn), sometimes degenerating into a wavy riblet; these tubercles are arranged much as in *T. colon*, but are narrower in a direction transverse to the whorl, with their transverse connections less evident, the spiral ridge proportionately stronger, and the tubercles individually less conspicuous; the two spiral rows of tubercles, especially in the anterior part of the shell, occupy the peripheral third of the visible part of the whorl; * the anterior and posterior thirds are somewhat excavated toward the suture, the shell being appressed and slightly raised on each side of the latter, but without forming a regular band or riblet, unless in the very last whorl where the raised edges are a little waved in sympathy with the tuberculation of the periphery; suture very distinct; the excavation above referred to gives a particularly rounded appearance to the whorls, resulting in a wholly different aspect from that given by the subcylindrical *T. colon*, which has twenty-three whorls in the same space as sixteen of *T. ibex;* base rounded with three strong raised threads between the anterior tubercular spiral and the canal; canal short, a little recurved at the tip; pillar with a strong callus; posterior canal and outer lip not completed in any of the specimens at hand, but the more adult ones indicate a rather wide roundish mouth; outlines of the spire a little concave from the button-like nucleus. Lon. of shell, 11.0; of last whorl, 3.0; of (immature) aperture, 1.5. Max. lat. of shell, 1.87; of nucleus, 0.5 mm.

Off Cape San Antonio, 640 fms. Yucatan Straits, 640 fms. Sigsbee, off Havana, 450 fms.

This shell tapers more rapidly than *T. colon*, as will be seen by the measurements, and differs in the other particulars mentioned from that species, which appears to be its nearest ally.

Cerithiopsis (?) Sigsbeana n. s.

Shell long, slender, excepting the inflated apex acutely conical, sides rectilinear, with about twenty-three whorls; color, nucleus translucent, first three or four whorls with a deep reddish brown tinge which gradually fades to waxen white, tinged irregularly with faint brown or yellowish suffusion, in dead shells pure white, polished and partly translucent; nucleus inflated, vitriniform, set on a little obliquely, projecting outward more than the two subsequent apical whorls, smooth, but latterly faintly sculptured in transition toward the regular sculpture of the shell by faint posteriorly concave transverse undulations; subsequent spiral sculpture of three and afterward four spiral flattened squarish ridges, the most prominent of which is the posterior, which is in front of and covers the invisible suture; before this are two equal and slightly but distinctly smaller ones, and lastly at the anterior margin of the shell (except in the very young specimens) a still smaller rather rounded thread, which forms the periphery of the base, and which a slight expansion of the last half-whorl in the adult covers up, so that there are only three spirals visible on this last small portion ; base nearly flat, with one rather marked spiral within the periphery, defined by a groove on either side, and between this and the canal numerous fine submicroscopic spiral striæ; in the earlier whorls the spirals are waved or even tuberculated by the transverse undulations, the large spiral most so and the anterior one least so, varying in amount in different specimens ; in a strongly sculptured specimen which was selected for description as living and perfect, the transverse sculpture (of about twenty faint undulations) is stronger than the spirals during the three or four apical whorls, gradually becoming fainter until on the eighteenth and succeeding whorls it is only visible between the spirals under a strong magnification ; for the greater part of the shell the spirals are not tubercled, but waved or slightly swollen at the intersection of the transversals, which last become fainter and more numerous from whorl to whorl, and on the base are not indicated, or only by moderately distinct lines of growth. On another larger specimen the tuberculations or undulations are perceptible only on the earlier third of the shell, and on the remainder are represented only by the lines of growth ; in this specimen the spirals also are less distinctly marked in the latter part of the shell, the two intermediate ones suffering most diminution ; on the surface spiral striæ exist, which are hardly to be detected on the first-mentioned strongly sculptured specimen ; the base is about the same in both. The sharp outer lip does not appear to be ever thickened, but at certain periods it is slightly reflected and this excessively thin edge is visible like a varix here and there on the whorls, although it hardly rises above their surface ; the aperture is squarish, short, and wide ; the inner lip glazed, but not thickened ; the outer lip concavely waved laterally and with the basal edge slightly produced ; the pillar solid, very short, strongly spirally twisted and forming a short but very distinct canal abruptly bent to the left ; operculum so far retracted as to be inaccessible ; soft parts indicated by a blackish tinge perceptible through the shell. Lon. of shell, 10.5 ; of last whorl, 2.0 ; of aperture and canal, 1.5. Lat. of shell, 1.75; of aperture, 0.9. Lon. of longest specimen when perfect, 13.25 mm.

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* Of course, proportionately much more in the earlier whorls.

Station 5, 229 fms. Station 20, 220 fms.

The genus *Cerithiopsis* appears to be at present ill defined, the character of the operculum used by Forbes being illusory, if Sars's figure is correct ; the differences of dentition between this form and *Bittium* appear quite sufficient to distinguish it, however, if other species agree. Nevertheless, it seems at present impossible to fully define either genus or to distinguish by the shell (except approximately) between species of *Bittium* and *Cerithiopsis* as these names have heretofore been applied. The differences in the soft parts which have been mentioned may exist, but like the asserted differences in the opercula prove on more thorough inspection to be partly transitional or specific characters. It will be understood, therefore, that the above and succeeding species are only provisionally referred to *Cerithiopsis*, and may hereafter be proved to belong to *Bittium* or to some allied group. Were the describers of new genera and subgenera to carefully describe the distinctions between the groups they name and their near allies, much labor would be saved those who come after, and who have to do the drudgery properly belonging to the original describer, if indeed he went so far as to give the data necessary for the search. Many genera really separated from one another by good characters are defined by most worthless ones in the text-books, and in no department is there more work to be done than in what may be termed that of giving a proper perspective to the innumerable named groups of mollusks.

This particular species is clearly different from any of those described by Watson, and I have been unable to find any described species with which it agrees.

Cerithiopsis (?) crystallina n. s.

Shell translucent white, elongate-conical, extremely acute, with granulated surface and about twenty-four somewhat rounded whorls; nucleus extremely minute and partly submerged, smooth, shining, translucent, passing imperceptibly into the very attenuated shining apical whorls, which in the adult are most frequently, though not always, lost; spiral sculpture in the earlier whorls of two rather strong subequal rounded revolving riblets, to which, about the seventh whorl, another smaller thread just before the suture is added, which soon becomes nearly as prominent as the posterior riblet of the original pair; the space between the original pair gradually grows proportionately wider, and about the tenth whorl a fine intercalary thread appears which always remains smaller than the others; beside this in the nearly adult shell the space between the original anterior riblet and the suture (to which this part of the whorl rapidly descends) is supplied with two very fine elevated threads; a similar one may also (but does not always) appear intercalated between each pair of the four principal spirals above described; on the base in the fully adult eight or more subequal simple spirals appear between the periphery and the canal, while the more anterior original spirals diminish in prominence and gradually approximate in size to the basal ones; in the younger shells the difference is quite strongly marked. The transverse sculpture in the apical whorls consists of a few (six or eight) rather strong transverse riblets, which appear as stout rounded tubercles on the spirals, and run down the spire almost straight, until the order is broken up by the continual appearance of new intercalary series (seventeen on the thirteenth whorl and about twenty-two on the last whorl); on the later whorls these are somewhat concavely flexed, and no regular succession up and down the spire can be made out; fine lines of growth appear on the anterior whorls, which by the constriction of the basal periphery put on a rather rounded outline, so that the number of whorls can be easily counted, though the suture is almost invisible; on the base the only transverse sculpture is due to the delicate lines of growth; the last whorl or two may have one or two faint varices; the base is flattish in the young, rounded in the adult; the outer lip expanded and thickened concave behind, basally produced and curving into a distinct but not produced canal, which opens to the left; on the other side the outer lip is continuous with a thin but distinct callus, which is twisted over the very short and inconspicuous pillar; the reflected edge of this callus is not adherent to the pillar, and there is a perceptible chink under it, or more properly above it; the aperture is subovate, pointed before and behind. Lon. of shell, 16.0; of last whorl, 3.62; of aperture (from point to point), 2.5. Max. lat of shell, 3.0; of aperture, 1.75 mm.

Station 2, 805 fms.; Barbados, 100 fms.; and numerous other localities.

A very pretty, and apparently a very common species, which, except in its attenuated apex has quite a general resemblance to *Lovenella metula* Sars of Northern European shores. From *Cerithium* (*Bittium*) *cylindricum* Watson (Australia) it differs in its color and in its non-convex outlines, and in having four instead of three prominent spirals and many more whorls; it has a larger number of series of tubercles than *C.* (*Bittium*) *gemmatum* Watson from Setubal, and two more spirals; it is much larger than *C.* (*Bittium*) *pigrum* Watson, and of all Watson's species is perhaps most like *C.* (*Bittium*) *mamillanum* from Pernambuco; but the details of sculpture, size, and number of whorls differ quite sufficiently.

Bittium (?) Yucatecanum n. s.

Shell stout, solid, conical, waxen white or grayish, with about eight rather rounded whorls; spiral sculpture of four (afterward five) revolving, flattened threads, with about equal interspaces; the first is about its own width, or a little more, in advance of the suture; the second, about the same distance in advance of the first, is equal to it in size; both are smaller than the third, which is the largest and most prominent of all, and gives a subcarinate appearance to the whorl, or than the fourth, which is about midway in size between the second and third; on the later whorls a fine thread appears just behind the suture which it crowns, and on the last turn forms the periphery of the base, within which appear two or three others, growing fainter toward the canal; the shell is also covered with microscopic revolving striæ; the transverse sculpture consists of fourteen to eighteen faint plications or riblets, which appear to pass under and in so doing to undulate the spirals, especially the third and fourth; in some specimens these undulations may appear tubercular, but they do not in the one under consideration; the sutural thread is not undulated, and the reticulation is confined to the sides of the whorls, the base being crossed only by rather strong lines of growth. Base rounded; pillar straight, rather slender, short, without any marked callus; aperture rounded; outer lip thin, notched by the spirals, with a faint emargination near the pillar, but no well-marked canal; the nucleus is mostly broken away, but seems to have been heliciform, turned half over, and partly immersed. Lon. of shell 8.0; of last whorl, 3.5; of aperture, 2.0. Max. lat. of shell, 3.0; of aperture, 1.5 mm.

Yucatan Strait, 640 fms.

A solid, rather uninteresting-looking shell, with few attractions, but differing from any of the species described by Watson.

Columbella (Astyris) Duclosiana D'ORBIGNY.

C. Duclosiana D'Orbigny, Sagra Moll. Cub., II. p. 136, Tab. XXI. figs. 31–33. 1853.

Station 20, 220 fms. Sigsbee, off Havana, in 450 fms.

These specimens, being dead, may have been washed off shore. The species might well be a variety of *C. dichroa* Sowerby, and faded specimens recall *C. lunata* Say.

Columbella (Astyris?) amphissella n. s.

Shell small, stout, blunt-tipped, yellowish white, of four and a half whorls; nucleus large, white, shining, smooth, and naticoid, of one and a half whorls; transverse sculpture of numerous (on the last whorl twenty-one) straight subequal plications with about equal interspaces, beginning at the suture, passing clear over the whorl, and fading out only when near the canal; also faint lines of growth; spiral sculpture of numerous equal fine rounded threads (twenty-one on the last turn) with slightly wider interspaces, covering the whole shell except the nucleus; pillar short, stout, a little concave, with a slight callus; outer lip somewhat thickened, smooth; canal wide, short, but distinct; sutures distinct. Lon. of shell, 4.0; of last whorl, 3.0; of aperture, 2.0. Max. lat. of shell, 2.0; of aperture, 1.0 mm.

Yucatan Strait, 640 fms.

This stout and prettily reticulated little shell has almost the form of *amphissa versicolor* Dall, from California, though of course on a very diminutive scale; the character of the sculpture is also not dissimilar. The nearest West Indian species to it is *Columbella Hotessieriana* D'Orbigny, which has a toothed aperture, one more whorl, an acute spire, and different color. It is not unlike *C. costulata* Cantraine as figured by Sars, but has a proportionately shorter spire, fewer whorls, more numerous plications, and is of about one ninth the size. By some authors this species would be referred to *Anachis.*

Columbella (Astyris) Verrilli n. s.

Shell slender, conical, yellowish white, with about seven whorls; surface polished, but when in a perfectly fresh condition covered by a rather shaggy brown epidermis, whose surface projects in irregular lamellæ, as in *Astyris californica.* Nucleus naticoid, shining translucent white; spiral sculpture appearing only on the pillar and basal surface where there are ten or twelve well-marked close-set revolving threads, which grow fainter toward the periphery; microscopic revolving lines may occasionally, though rarely, be seen on other parts of the shell ; transverse sculpture varying with different individuals ; in those where it is strongly developed it consists of from nine (on the third whorl) to fourteen (on the last whorl) sharp-edged plications running clear across the whorls, rounder and wider near the middle of the whorls, and on the last disappearing half-way from the periphery to the canal; these plications run straight up and down the spire, and are strongest (though rather narrower) at their posterior ends, at which the plication often rises into a little tubercle, which is not only appressed against but even extends over the suture, which, in consequence, has a wavy outline ; the spaces between the plications are wide and evenly excavated ; in other specimens the plications will be much fainter, not raised into a tubercle at their posterior ends and evanescent on the larger whorls at a short distance in advance of the suture ; the suture in such specimens is more even and distinct than in those previously described, and the lines of growth are usually more evident. The pillar is stout, twisted a little to the left, and, with the canal, distinctly recurved, its inner side covered with a thin smooth white callus ; the outer lip gently arched, slightly thickened, and reflected, contracted a little at its anterior end to form the short wide canal, and having internally, about midway between its junction with the body whorl and the canal, a single small rounded pustule-shaped callus ; there are no denticles or other armature to the mouth with the above exception, which is invariably present in perfectly mature specimens. A moderately plicate shell measured as follows : — Lon. of shell, 9.0 ; of last whorl, 5.0 ; of aperture, 3.5. Max. lat. of shell, 3.0 ; of aperture, 1.5 mm. Another strongly sculptured specimen measures 9.25 mm. long and 3.12 mm. broad.

Sculptured variety, Station 2, 805 fms. ; Station 19, 310 fms. ; Station 47, 331 fms. Normal form, Station 43, 339 fms. ; Station 47, 331 fms.

This species is most nearly allied to *Astyris rosacea* Gould, from which the faintly sculptured specimens differ by the smaller mouth in proportion to the spire, and the characters of the epidermis and aperture ; the character of the plications also differs from that of *A. rosacea*. The strongly sculptured specimens do not at all resemble *rosacea*, except in size and number of whorls. The latter would usually be referred to *Anachis* and the former with *A. rosacea* to *Astyris*, but there can be no doubt that they are forms of one species. This without prejudice to the proper separation, maybe, of certain species under the name of *Anachis*.

This species was obtained in some numbers, so that I was prepared to find it described ; but a pretty thorough search has not revealed any reference to it in the various publications I have consulted. Professor Verrill, to whom I have great pleasure in dedicating it, may perhaps secure it with other Southern forms off the coast of New England during the researches he is now conducting. The solitary pustular denticle is a very peculiar, and, as far as I am aware, unique feature.

Natica leptalea Watson.

N. leptalea Watson, Journ. Linn. Soc. (Zoöl.), XV. p. 261. Dec. 1880.

A small specimen, perhaps the young of the above species, was dredged in 640 fathoms in Yucatan Strait. Watson's specimens were from near Sombrero Island, W. I., in 450 fathoms.

Natica fringilla n. s.

Shell small, elevated, slightly turreted, blunt-tipped, wavy white, of three or four whorls ; nucleus translucent, polished, rather disproportionately large, depressed nearly to the level of the next whorl, and so giving the spire a blunted aspect ; transverse sculpture of strong plications like the "gathers" of a skirt, about thirty-two on the last whorl, not perfectly uniform in elevation or extent, passing forward from immediately in front of the suture a distance of about 1.25 mm., and then becoming obsolete or replaced by ordinary lines of growth ; these plications are sharp-edged near the suture with about equal interspaces, and gradually grow wider, flatter, and less elevated anteriorly until they disappear ; surface polished, lines of growth not prominent ; spiral sculpture none, though the surface is marked with those faint revolving markings, visible only by reflected light, which are common to nearly all spiral polished shells, and, as far as I have observed, to all species of this genus ; suture well marked, slightly appressed ; whorls rounded behind and laterally in female, and slightly laterally flattened in male specimens ; base prettily rounded ; umbilicus small, funiculate at its mouth, twisted, with a rounded not very distinctly defined riblet coiled on its inner surface, beginning from the anterior end of the pillar lip ; no umbilical pad ; outer lip simple, sharp-edged, a little oblique, and, at maturity, slightly bent downward and forward at its junction with the body whorl ; pillar-lip and body moderately thickened, an emargination in front of and corresponding to the umbilical arch ; aperture rounded in front, pointed behind. Lon. of shell, ♂ 7.0, ♀ 5.75 ; of aperture, ♂ 4.0, ♀ 4.0. Max. lat. of shell, ♂ 5.0, ♀ 5.0 ; of aperture, ♂ 2.5, ♀ 2.5 mm., the ♀ being a somewhat younger shell.

Yucatan Strait, 640 fms. Off Cape San Antonio, 640 fms.

Among all the descriptions of forms from deep water, I have found none which apply to this rather simple little species, which is about the size of *N. pusilla* Say, but quite distinct from it. In his report on the French expedition of the *Travailleur* in the Bay of Biscay, Dr. Jeffreys mentions as new, but does not describe, a *N. subplicata*, which, from the name, might be allied to this.

Turritella Yucatecanum n. s.

Shell small, thin, acute, opaque white mottled with rusty brown, of about twelve whorls ; nucleus and second turn minute, white, smooth, with deep suture, rounded and vermicular; next whorls with spiral sculpture, whereof three riblets about equidistant are markedly larger and more prominent than the rest; sculpture of mature whorls consisting of fine spiral threads with nearly equal interspaces crossed by fine lines of growth and divided into five bands by four larger polished spirals, which are white and marked by rather distant dots of brown; of these bands of fine spirals that behind the anterior suture and the two immediately behind it are of about equal width and equal to the two posterior bands and their included large spiral taken together; the general surface, barring the large spirals, is marked by light nebulous transverse pencillings of brown, which in general accord in direction with the lines of growth; the whorls are hardly at all rounded laterally, are slightly carinated by the three major spirals, and the last whorl is flattened on the base, but without any marked carina at the periphery of the base; spiral sculpture of the base similar to that of the spaces between the major spirals on the side of the whorls, with here and there a slightly larger thread; the transverse sculpture consists of the lines of growth above mentioned, which are most distinct on and between the minor spirals and irregular narrow undulations following the lines of growth (about twenty-five to the last whorl), which cross the larger whorls in some specimens so prominently as to render the major spirals almost tuberculate at their intersection, in most specimens produce a series of moderate undulations, and in others are almost obsolete; outer lip thin, sharp, very little rounded, and hardly emarginated by the slight flexuosity of the lines of growth; pillar rather thin, prettily arched, passing into the flattened basal edge; body polished, not callous; suture rather indistinct, not channelled; base in several specimens dotted with convex, ovate, coriaceous, light yellow ovicapsules, whose surface, wrinkled in drying, seemed to have originally been smooth, and to have had a length of 0.75 and a breadth of 0.5 mm. Lon. of shell, 16.5; of last whorl, 5.5; of aperture, 3.25. Max. lat. of base, 5.0; of aperture, 2.75 mm.

Yucatan Strait, 640 fms.

This species perhaps most resembles a miniature edition of *T. leucostoma* Valenciennes, but does not agree with any of Watson's species or with the few species ordinarily assigned to the West Indian province. Quite a number of fresh specimens were obtained, which are very uniform in size, disposing of the suspicion that the shell might be drifted from shallow water.

Actæon fasciatus Lamarck.

A species which may be the *Tornatella fasciata* of Lamarck, judging by figures only, was obtained from Station 19, 310 fms.; by Sigsbee, Station 50 (Lat. 26° 31′ and Lon. 85° 53′ W.), in 119 fms.; Station 9, 111 fms. (young); and from 450 fms. off Havana, also a young specimen.

Actæon incisus n. s.

Shell short, thin, inflated, waxen white, polished, with five or six whorls and a rather acute spire ; nucleus minute, more or less immersed, eroded to some extent in every specimen ; apical whorls smooth, polished, rounded ; suture very distinct, in the majority of cases not channelled ; the apical whorls with two or three distant narrow grooves across which, in some cases, pass elevated lines of growth which appear nowhere else, or, if at all, only in the suture near the apex ; last whorl forming the largest part of the shell, inflated, provided with ten or eleven spiral grooves, which are nearer together anteriorly ; these grooves are somewhat zigzag by exigencies of growth, but are not punctate, as in so many species ; other spiral sculpture consisting of microscopically fine slightly zigzag striæ, about seventy in the width of a millimeter ; transverse sculpture only of most delicate flexuous lines of growth most evident near the sutures ; aperture rounded in front, pointed behind ; outer lip thin, simple, arcuated toward the periphery, passing imperceptibly into the pillar ; body with a slight callus joining the rather slender pillar which carries one inconspicuous fold. Lon. of shell, 9.0 ; of last whorl, 7.0 ; of aperture, 5.75. Max. lat. of shell, 5.75 ; of aperture, 3.0 mm.

Yucatan Strait, 640 fms. ; off Cape San Antonio, 640 fms.

A peculiarly thin delicate polished and inflated species.

Actæon melampoides n. s.

Shell short, stout, with a depressed spire and shouldered last whorl ; white, with five whorls, sculptured with punctate spiral lines ; nucleus small, eroded ; other whorls with two, three, or (on the last) twenty to twenty-five spiral lines, which are distinctly punctate, with about ten punctations in the length of a millimeter ; the spirals are crowded just in advance of the suture and near the pillar, and especially distant on the shoulder of the last whorl ; suture distinct, with the anterior margin finely crenulate in the last whorl ; other sculpture of fine lines of growth and microscopic revolving striæ as in the last species ; outer lip hardly oblique, joining the body at a wider angle than usual, owing to the shouldering of the last whorl, thin, simple, passing imperceptibly into the short, twisted pillar, which bears a single distinct fold ; body whorl with only a glaze, pillar hardly or not at all thickened ; aperture approximately lunate. Lon. of shell, 6.0 ; of last whorl, 5.25 ; of aperture, 4.25. Max. lat. of shell, 4.0 ; of aperture, 1.62 mm.

Station 19, 310 fms.

This species has a good deal the outline of the common *Melampus corneus* of the east coast of America.

Actæon Danaida n. s.

Shell elongated, moderately pointed, polished, white, and having about six whorls; spiral sculpture of (on the spire) six, or (on the last whorl) over twenty-five punctate grooves, more crowded anteriorly, but with two or three coarser than the rest, just in advance of the suture; between these original grooves in the latter half of the last whorl intercalary single or double grooves appear, which are seldom quite as deep as the originals, and at first are not punctate, but at last, and especially near the anterior extreme of the shell, become nearly as well marked as the original series; transverse sculpture consisting only of lines of growth, by a peculiar thickening of certain of which when they cross the grooves the punctate appearance is produced; nucleus eroded, minute; suture appressed, distinct, but the thin appressed anterior margin seems peculiarly liable to erosion, which in some cases takes place so as to produce the appearance of a channelled suture; whorls slightly rounded; outer lip thin, simple, somewhat produced in the middle, passing imperceptibly into the thin twisted pillar, which is slightly reflected, and bears one inconspicuous, very oblique fold; body with a thin layer of callus; aperture rounded in front, rather narrow, pointed behind; no umbilical chink in this or any of the preceding species. Lon. of shell, 11.0; of last whorl, 7.75; of aperture, 6.25. Max. lat. of shell, 5.25; of aperture, 3.0 mm.

Station 43, 339 fms.

An elegant and excessively punctate species, which looks as if it might have been pelted by a shower of little coins.

Actæon perforatus n. s.

Shell small, pointed, waxen white, with a narrow opaque yellowish band in advance of the suture, composed of about six whorls, and with a distinct umbilical perforation; nucleus eroded, small; spire with about six, or (on the last whorl) eighteen strong and very regularly and distinctly punctate grooves, the punctations at the rate (near the aperture) of about six to a millimeter, the grooves a little more crowded anteriorly and distant posteriorly, the interspaces everywhere wider than the grooves and with no intercalary grooves or striæ whatever; transverse sculpture of faint lines of growth; aperture rounded in front, pointed behind; outer lip thin, simple, arched, and continuous with the reflected thin pillar lip, upon which a fold can hardly be made out; body with a slight glaze; umbilical perforation straight, with smooth walls, apparently very deep, and about 0.25 mm. in diameter. Lon. of shell, 7.75; of last whorl, 6.0; of aperture, 4.0. Max. lat. of shell, 4.62; of aperture, 2.0 mm.

Station 2, 805 fms.

The anterior part of the last whorl being a little larger than any part posterior to it, this shell has a somewhat pyriform appearance.

Sept. 26, 1881.

Ringicula nitida Verrill.

Ringicula nitida Verrill, Am. Journ. Sci., V., 3d series, pp. 6, 16, 1873. H. Morlet, Journal de Conchyl., Vol. XXVI. p. 127, 1878.

Pourtalès, bed of the Gulf Stream, 447 fms. Station 43, 339 fms. Yucatan Strait, 640 fms.

This is very different from *Ringicula semistriata* D'Orbigny (Sagra, Moll. Cub., II. 103, Tab. XXI. figs. 17–19), and considerably larger.

It has six whorls; the anterior fold on the column is distinctly the largest; the outer lip in mature specimens is thicker in the middle and anteriorly than elsewhere; the parietal tooth is obsolete; and there is in perfect specimens a well-defined area on the base, anterior to the junction of the outer lip and body, which is distinctly grooved, the remainder being smooth. It reaches a length of 7.5 and a breadth of 5.00 mm.

Bulla abyssicola n. s.

Shell of moderate size, and nearly the shape of *B. ampulla*, but proportionately wider behind, white with an ill-defined band of pale yellow brown encircling the periphery; aperture as long as the shell; outer lip simple, nearly straight, rounded before and behind, not extending beyond the summit of the left side of the shell; apex depressed, immersed, forming a slight pit with none of the whorls visible; surface ornamented with fine, minutely punctate spiral grooves, more crowded before and behind, more distant about the periphery, from four to twelve in the width of a millimeter and from eight to ten punctations in the length of a millimeter, according to the part of the shell examined; besides these there are numerous still finer striæ, also punctate, but more finely, which, when very faint, appear like rows of very faint puncticulations; otherwise the surface is smooth, or even polished, the lines of growth hardly perceptible; aperture narrow behind, wide in front, the pillar reflected, and a thin layer of callus evenly spread over the body within the aperture; proportions of younger specimens much the same, but a little more pointed at the extremities. Lon. of shell and aperture, 12.75. Max. lat. of shell, 9.0; of aperture, 5.25; min. lat. of aperture, 1.5 mm.

Yucatan Strait, 640 fms. Station 43, 339 fms. (young).

The genera of these opisthobranchiates must always be uncertain in the absence of the soft parts. To the species here described from the shells alone the generic names applied must necessarily be provisional. The present one shows no characters in the shell by which it might be separated from the typical species of the genus, unless it be the absence of distinct coloration which we should naturally expect in a species from great depths.

Bulla (?) eburnea n. s.

Shell small, ivory-white, polished, ovate, the aperture extended posteriorly a little beyond the left hand summit of the whorl ; sculpture a few spiral grooves near either extremity, more numerous and crowded anteriorly ; these grooves somewhat zigzag from irregularities of growth, but not puncticulate ; remainder of the shell without sculpture, except most minute microscopic faint indications of spiral striæ and faint lines of growth ; apex minutely pitted, but the pit nearly covered by a small reflexion of the lip where it joins the posterior face of the body ; outer lip thin, sharp, curved round and reflected at the anterior end of the axis ; a thin deposit over the body within the aperture. Lon. of shell and aperture, 7.25. Max. lat. of shell, 4.25 ; of aperture, 2.0 ; min. lat. of aperture, 0.75 mm.

Station 43, 339 fms.

The description of *Diaphana gemma* Verrill is the only thing I can find which bears any resemblance to this species ; but the size and proportions of that species are different, it is umbilicated, and *B. ? eburnea* does not seem likely to prove a *Diaphana*.*

Atys (?) bathymophila n. s.

Shell large, stout, white, polished, sculptured with numerous puncticulate striæ, crowded toward the ends and few and distant in the middle ; outer lip extending backward a short distance from the spire, then sweeping downward, forward, outward, and then upward, curving downward and backward again to join the subtruncate columella, above and behind which there is almost a canal ; columella reflected, with a tolerably thick callus, but no umbilicus or umbilical chink ; body with a thin deposit of callus (in one instance much thickened and roughened, apparently by disease); aperture very narrow behind, very wide and somewhat oblique in front ; lines of growth on the surface hardly visible. Lon. of shell and aperture, 16.5 ; from summit to oblique truncation of columella, 13.75. Max. lat of shell, 11.25 ; of aperture, 7.0 ; min. lat. of aperture, 1.0 mm.

Station 33, 1,568 fms.

In young specimens 3.5 mm. long there are three and a half whorls ; the nucleus is visible turned on its side and half immersed ; it is heliciform, translucent white, and minute ; the striation is more uniformly distributed over the shell, and is exceedingly fine ; the nucleus (but not the whorls outside of it) remains partly visible until the shell has attained a length of 8.25 mm. Like most young shells of this group, the young are more pointed before and behind, and less expanded than the adult.

Yucatan Strait, 640 fms.

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* A comparison of specimens shows that they are perfectly distinct.

This may not be an *Atys*, but the subtruncate axis and general form of the shell are more like that group than any other, and it is so referred until we know the soft parts.

Atys (?) Sandersoni n. s.

Shell small, thin, fragile, polished, translucent white, with the aperture longer than the axis of the shell, slender, elongated oval with the posterior fourth bevelled off slightly ; transverse sculpture solely of delicate evanescent lines of growth, sometimes lost in the general polish of the surface ; spiral sculpture of about a dozen incised lines near either extremity, more crowded toward the tips and obsolete toward the middle of the shell, reticulating the lines of growth when the latter are present, but delicate, extremely fine, and not puncticulate ; posterior apex a rather deep funiculate pit, out of the centre of which rises the margin of the aperture, which is here slightly reflected, extends behind the summit of the body and suddenly curves forward, leaving a very narrow aperture, which is produced into a rounded point in front, then sharply recurved and reflected to a point where the reflected part loses itself in the thin callus on the body within the aperture ; the anterior reflection is sometimes closely appressed and sometimes loose with a chink behind it, but there is no anterior pit ; the shell is more slender forward than behind, the bevelling is more marked in some specimens than in others; a fragment from off Havana, if conspecific as seems likely, indicates that it reaches a much larger size than the described specimens. Lon. of shell and aperture, 6.5. Max. lat. of shell, 3.4 ; of aperture, 1.75 ; min. lat. of aperture, 0.5 mm.

Station 2, 805 fms. Off Havana (?), Sigsbee, in 450 fms., a fragment which, if perfect, would be about 5.5 mm. broad and 11.0 mm. long.

I have much pleasure in dedicating this species (which is provisionally referred to the genus *Atys*) to Mr. Sanderson Smith of the U. S. Fish Commission, well known by his researches among the marine mollusks of N. E. America. Its nearest ally seems to be the *Bulla caribbœa* D'Orbigny, which is much smaller, more globose, and entirely covered with striæ.

Philine sp.

A fragment of a species resembling *P. quadrata* Wood, as figured by G. O. Sars (Tab. 18, fig. 9 a), was obtained in Yucatan Strait at a depth of 640 fms. It is of a yellow brown, with strong lines of growth crossed by very numerous puncticulate grooves all over the surface.

Scaphander (?) Watsoni n. s.

Shell slender, delicate, white or yellowish, polished, posteriorly attenuated, with the outer lip and aperture produced behind the apex ; transverse sculpture, none beside the delicate lines of growth, which are perceptible chiefly at or near the tips; spiral sculpture consisting of some twenty-five sharp, strong, channelled, clear-cut grooves, not punctate or in any way irregular, except that they are more crowded near the summit than elsewhere, about half being within the posterior third of the shell; between these, near the extremities, and near the margin of the outer lip, are a few more delicate intercalary grooves; posterior apex a minute pit, punctured in the centre, from which the free margin rises, extends backward somewhat more than half a millimeter, then downward, forward almost in a straight line, then with a wide sweep up and around to join the slightly thickened margin of the body, into which it passes imperceptibly; body with a light wash of callus; axis coiled so as to be pervious to the summit when viewed from in front. Lon. of shell and aperture, 8.75. Max lat. of body, 2.5; of entire shell, 4.25; of aperture, 3.25; min. lat. of aperture, 0.75 mm.

Off Sombrero Island in 72 fathoms.

It is possible that this will prove to be a *Philine* when the animal is known, but the form and aspect are those of a *Scaphander*. In general outline it recalls *S. lignarius* L., though more slender, more attenuated and pointed behind and with the free margin more produced posteriorly. In the former characters it resembles *Philine Loveni* Malm, as figured by G. O. Sars, but is still more pointed behind, and the free margin is of quite a different shape.

This is a remarkably elegant and characteristic species, and is named in honor of my friend, Mr. R. Boog-Watson, who is working up the Mollusca of the Challenger Expedition.

Utriculus (?) vortex n. s.

Shell stout, rather solid, opaque white, short, the posterior fourth bevelled off toward the bluntly rounded summit; transverse sculpture consisting of occasional faint lines of growth, nowhere very prominent; spiral sculpture consisting of very numerous fine grooves, so crowded near the ends of the shell as to be but little narrower than the interspaces; these grooves are only visible under a lens, are occasionally reticulated by the lines of growth and gradually become more distant toward the middle of the shell; just in advance of the shoulder of the bevel are a small number of equally fine *raised* lines, which are so minute that only by the most careful inspection and under strong magnification can they be distinguished from the grooves which cover the rest of the shell; the folds of the outer whorl are appressed toward the apex, with a somewhat thickened and irregular margin, which leaves a minute pit at the summit and about two volutions visible; this appressed margin is often eroded, and then some four or five turns can be made out; in advance of the bevel the shell is nearly cylindrical, rather suddenly rounded in front; outer lip straight, slightly produced in the middle, but not bent inward toward the body, passing imperceptibly into the column, over which, as well as over the body, is a thin layer of callus; aperture rounded and rather wide in front, narrowing to an acute point behind, shorter than the shell ; pillar with no twist or fold, continuous with the margin. Lon. of shell, 7.5 ; of aperture, 6.0. Max. lat. of shell, 4.25 ; of aperture, 2.5 mm.

Station 43, 339 fms ; Station 44, 539 fms.

After comparing this with the figures of all the Northern species given by Sars and those from the West Indies by D'Orbigny, it seems quite distinct from any of them. It is possible that it may prove to be a *Cylichna* when the animal is known ; but it does not agree with any of the figured *Cylichnæ*.

Utriculus (?) Frielei n. s.

Shell rather large, solid, polished opaque white, broader behind than before its middle ; apex perforate, around which the margin of about two turns is usually visible ; this margin, formed by the rather broad ⊐-shaped posterior sinus of the aperture, resembles the notch-band of some *Pleurotomidæ* in that the surface is flattened, with a well-marked boundary on each side, and on this surface the successive marginal edges are often raised into scales, one fitting into another, composed of an extension of the body callus on one side and a reflection of the free margin on the other; the surface of the band varies in different specimens from nearly smooth to distinctly and regularly undulated or imbricately scaled as above mentioned ; other transverse sculpture of lines of growth which are hardly visible while of spiral sculpture there is none, though, with a strong reflected light, under the microscope numerous spiral markings may be observed which are neither grooved nor raised, but are visible in most smooth spiral shells, and are probably due to growth, somewhat as are the lines commonly recognized as "lines of growth." Aperture nearly or quite as long as the shell, narrow, rounded in front, and terminating in the ⊐-shaped sinus behind ; outer lip straight, sharp, thin, not incurved, rounded to join the stout columella into which it passes imperceptibly ; pillar broad, short, with a thin callus which also extends along the body ; shell widest about the posterior third ; distinctly narrowed anteriorly. Lon. of shell and aperture (the latter occasionally a trifle less), 8.2. Max. lat. of shell (at posterior third), 4.0 ; at anterior third, 3.5 ; of aperture, 1.75 ; min. lat. of aperture, 0.5 mm.

Off Cape San Antonio, 640 fms.; Yucatan Strait, 640 fms.

None of the Northern species present the characters of *U.* (?) *Frielei*. *U. truncatulus* Brug., as figured by Sars (Tab. 18), should have a somewhat similar summit, though the lines are not ⊐-shaped, but obliquely transverse in the figure ; the other characters of that shell are quite different, and it does not reach half the size of *U.* (?) *Frielei*. None of those figured by D'Orbigny are at all like the present species, which it gives me pleasure to dedicate to Mr. Hermann Friele of Bergen, naturalist (in charge of the Mollusca) of the Norwegian Deep-sea Expedition on the *Vöringen*, and well known for his work on the collections of that expedition and for his valuable researches on the development of *Waldheimia*.

NOTES.

Before passing to the Acephala and Brachiopoda it may be well to note that in the preceding descriptions the apex or nucleus is considered the posterior end of the shell, and in dextral shells the free margin as the right-hand side of the shell ; such lines or sculpture as pass along the whorls are spiral or longitudinal ; such as pass across the whorls are transverse.

Dr. J. Gwyn Jeffreys has kindly pointed out to me that the name *maculata* is preoccupied in the genus *Margarita* for a fossil species by Wood. The species described by that name on page 43 will therefore take the name of *Margarita lacunella.*

Dr. Jeffreys has also forwarded to me some specimens of the shell described under the name of *Margarita* (?) *euspira* (page 44), but which are destitute of the sutural band, forming a variety which may take the name of *nitens* (Jeffreys). The genus of this peculiar little shell remains in doubt. It presents some characters in common with *Margarita* and some with *Photinula.* In nearly adult specimens the pillar is broad, flattened, and granulated minutely with a polished small tubercle at its end, which later becomes enlarged, and forms a blunt tooth, or prominent rounded tubercle, which also is rough or granulated on the surface (which at first, with only a few specimens for comparison, led me to the supposition that it was due to fracture), and is shown by the additional material of Dr. Jeffreys to be a normal feature unlike anything I find described. If it be considered desirable to separate it on this ground (and it certainly cannot remain with typical *Margarita* or be referred to *Photinula* or *Oxystele* as strictly defined), it might take the name of *Bathymophila*, and for the present be considered as a subgenus of *Margarita*, which genus it resembles entirely when immature, being then widely umbilicate and with no callus.

Professor Verrill has called my attention to the fact that the species described as *Pleurotoma* (*Bela*) *limacina* (page 55), also obtained by the U. S. Fish Commission in deep water off Newport, R. I., has no operculum, and hence is probably not a *Bela.* None of my specimens retained the animal. An examination of a specimen in spirits kindly lent by him confirms this view, and for the present the species were perhaps better referred to *Daphnella.* The family divisions of Gray, Adams, and others, based on the characters of the operculum, in the light of later researches cannot be maintained. I have elsewhere shown that in *Buccinum cyaneum* about five per cent have no traces of an operculum, while Friele has described a *Neptunea* or *Chrysodomus* with a subspiral operculum (*Mohnia alba*). In the *Toxifera* it is highly probable that the operculum has at most a generic value.

BRACHIOPODA.

Terebratulina Cailleti Crosse.

T. Cailleti Crosse, Journal de Conchyliologie, XIII. p. 27, Pl. I. figs. 1–3, 1865; Dall, Bull. Mus. Comp. Zoöl., III. No. 1, p. 10, 1871.

Barbados, 100 fms., abundant; Sigsbee, off Havana, in 80, 119, 127, 240, and 450 fms.; Yucatan Strait, 640 fms., living; Station 2, 805 fms., living; West Florida, 30 fms.; Station 16, 292 fms.; Station 20, 220 fms.; Station 44, 539 fms.; Station 45, 101 fms.; Off Morro Light, Station 16, 292 fms.; Santa Lucia, Station 218, 164 fms.; St. Vincent, Station 232, 88 fms.

Terebratula cubensis Pourtalès.

T. cubensis Pourtalès, Bull. Mus. Comp. Zoöl., I. No. 7, p. 109, 1867; Dall, Bull., *loc. cit.*, p. 3, Pl. I. figs. 2, 8–16, 1871.

Station 45, 101 fms.; Station 16, 292 fms.; Sigsbee, off Havana, 175 fms.; Lat. 26° 31′, Lon. 85° 3′, 119 fms.; Barbados, 100 fms.; Station 232, St. Vincent, 88 fms.; Station 202, Martinique, 210 fms.

Eudesia floridana Pourtalès.

Waldheimia floridana Pourtalès, Bull., *loc. cit.*, p. 127; Dall, *loc. cit.*, p. 12, Pl. I. fig. 3, Pl. II. figs. 1–3, 1871.

Off Sand Key, 125 fms.; Sigsbee, off Havana, 175 fms.; Lat. 26° 31′, Lon. 85° 3′, 119 fms. Very young specimens from Station 45, 101 fms.; Station 5, 229 fms.; and Station 19, 310 fms.

Waldheimia being preoccupied in insects, as heretofore pointed out, *Eudesia* is the next in order of priority.

Cistella lutea Dall.

C. (? *Barrettiana* var.) *lutea* Dall, Bull., *loc. cit.*, p. 20, Pl. I. fig. 5, Pl. II. figs. 4–8, 1871.

Sigsbee, off Havana, 80 to 127 fms.; Barbados, 100 fms; Station 21, 287 fms.; Tortugas, 30 fms.

Cistella Barrettiana Davidson.

Argiope Barrettiana Davidson, P. Z. S., Feb. 1866, p. 103, Pl. XII. fig. 3.
Argiope antillarum Crosse and Fischer, Journ. de Conchyl., XIV., July, 1866, p. 270, Pl. VIII. fig. 7.
? *Argiope Schrammi* Crosse and Fischer, *loc. cit.*, p. 269, Pl. VIII. fig. 6, 1866.
C. (? *Schrammi* var.) *rubrotincta* Dall, Bull., *loc. cit.*, p. 19, Pl. I. fig. 6, 1871.

C. Barrettiana var. rubrotincta.

Sand Key, 80 fms. ; Station 2, 805 fms., dead valves ; Yucatan Straits, 640 fms., valves ; Station 45, 101 fms., living ; Station 20, 220 fms. ; Barbados, 100 fms. ; Sigsbee, off Havana, 450 fms. valves ; Station 276, 94 fms. ; Station 231, St. Vincent, 95 fms. ; Tortugas, 43 fms.

C. Barrettiana (?) var. Schrammi.

Station 45, 101 fms. ; Barbados, 100 fms.

Platidia anomioides Scacchi.

P. anomioides Costa, Fauna del Reg. Nap., p. 47, 1852 ; Dall, Bull., *loc. cit.*, p. 18, 1871.

Terebratula anomioides Scacchi, Phil. Moll. Sic., II. p. 69, Pl. XVIII. fig. 9, 1844.

Near Morro Light, Cuba, Station 16, 292 fms. ; Station 253, 92 fms. : Barbados, Station 280, 221 fms. ; Granada, Station 260, 291 fms. ; St. Vincent, Station 232, 88 fms.

Thecidium Barretti Woodward.

T. Barretti Woodward, Davidson, Geol. Mag., I., Pl. II. fig. 1–3, 1864 ; P. Z. S., 1866, p. 104.

Barbados, 100 fms. ; Station 232, St. Vincent, 88 fms. ; Station 155, Montserrat, 88 fms.

These specimens I take to be *Barretti*, though very small, since they do not show the complicated internal arrangement of the next species.

Thecidium mediterraneum Sowerby.

T. mediterraneum Sowerby, Thes. Conch., VII. p. 371, Pl. 73, figs. 30–32 ; Dall, Am. Journ. Conch., VI. p. 151, fig. 27, 1870.

Station 241, 163 fms.

Crania Pourtalesii Dall.

Crania (? *anomala* var.) *Pourtalesii* Dall, Bull., *loc. cit.*, p. 35, Pl. I. fig. 7, 1871.

A single valve was found among coral from St. Vincent, W. I., obtained at a depth of 88 fathoms at Station 232. Those previously described were from Sand Key, Florida, in 105 fathoms, and from off the Sambos, in 116 fathoms.

Other species of Brachiopods appear in some numbers in the Agassiz-Bartlett collection, among which ? *Megerlia incerta* Davidson was recognized ; but these will form the subject of a supplementary report.

ACEPHALA.

VERTICORDIA (Wood) Sowerby.

Verticordia ornata D'Orbigny.

Trigonulina ornata D'Orbigny, Sagra, Moll. Cub., II. p. 292, Pl. XXVII. figs. 30–33, (1846) 1853.

Hippagus novemcostatus Adams and Reeve, Voy. Samarang, Zoöl., p. 76, Pl. XXIV. fig. 1, 1850.

Trigonituna ornata Chenu, Man., II. pp. 169, 322, fig. 843, 1862.

Verticordia ornata Fischer, Journ. de Conchyl., X. p. 380, 1862.

Barbados, 100 fms.; Station 19, 310 fms. [Catalina Island, California, 16 fms., Dall; shell sand, Jamaica, W. I., D'Orbigny; China Seas, Adams.]

This species has no epidermis, as erroneously stated in the Zoölogy of the Samarang, and copied by various authors. That specimen may have been covered with some extraneous substance, which in drying gave the impression of an epidermis. A careful examination of fresh specimens from California, and of fresh specimens of other species, reveals no sign of any epidermis, nor of any ossicle, as reported by Adams. The latter, seen only in one instance, may have been a concretion accidental to the individual, as often happens in bivalves. Nevertheless, I am of the opinion that the reference of the genus to the *Anatinidæ* will probably be sustained, as it seems much more probable than any relationship to the porcellanous *Isocardia* or *Cardita*. The number of ribs varies from eight to eleven, but is usually ten.

Verticordia acuticostata Philippi.

Hippagus acuticostatus Philippi, Moll. Sic., II. p. 42, Tab. XIV. fig. 19, 1844. (Fossil in Miocene of Calabria.)

Iphigenia acuticostata Costa, Pal. del Regno Nap., p. 160, Tav. XIII. fig. 9, 1850. (Fossil.)

Verticordia acuticostata Seguenza, Journ. de Conchyl., VIII. p. 291, Pl. X. fig. 1 a–e, 1860. (Fossil.)

? *Verticordia Deshayesiana* Fischer, Journ., *loc. cit.*, X. p. 35, Pl. V. figs. 10, 11, 1862.

? *Verticordia japonica* A. Adams, Ann. Mag. Nat. Hist., Mar. 1862, p. 224. (Insufficiently described.)

Station 31, 84 fms.; Station 5, 229 fms.; Barbados, 100 fms. [China, Fischer; Gotto Id., Japan, A. Adams, 71 fms.]

The form which I refer to Philippi's species (and all of whose synonyms I suspect may perhaps some time be referred with it to the original type *V. verticordia* S. Wood) is a little more like Fischer's figure of *V. Deshayesiana* than Seguenza's figure of *V. acuticostata*. However, specimens enough are at hand to show that the shell has a larger amount of variation than the few specimens in cabinets have led authors to suspect. *V. cardiiformis* (= *V. verticordia*) has sixteen ribs ; *V. acuticostata*, thirteen to fifteen ; *V. Deshayesiana*, seventeen ; my specimens have from fourteen to seventeen ribs, which may be stronger or weaker, finely or more sharply granulated, more or less markedly denticulate on the margin.

The descriptions of Mr. Adams are quite insufficient to identify any species by. No measurements are given, the number of ribs is not even stated, and the only differences of any value between his diagnoses of the two forms he names are, that one is "convexa" with "costis multis subdistantibus," while the other is "subcompressa" with "costis numerosis confertis." Such descriptions are rubbish, and a detriment to the progress of science. Yet the fact that they are in Latin gives them for some "conservative" writers a great charm, though they are perfectly useless for any practical pnrpose.

Verticordia Fischeriana n. s.

Shell of the same general form as *V. verticordia* Wood, or *V. Deshayesiana* Fischer, from which it differs in the number of ribs, which range from 27 to 35, being subequal with equal interspaces, and which merely crenulate the margin instead of extending beyond it in sharp denticulate points ; the lunule is less impressed than in either of the preceding species ; from *V. granulata* it differs by the larger number of ribs and by its striated and granulose lunule ; also by its more quadrate or subcircular rather than triangular form ; the granulation, however, is regular and even. as in that species, which is only known from a single valve found in the Sicilian tertiaries. Lon., 10.0 ; alt., 10.5 ; diam., 10.5 mm. Most of the specimens smaller. Barbados, 100 fms.; Sigsbee, off Cuba, 119 fms.; Station 36, 84 fms.

The granulated, non-pearly surface, the nacreous under-layer, the peculiar disposition and character of the teeth and ligament (first correctly described by Seguenza), the transverse costæ, the simple pallial line and peculiar muscular scars (of which there are four in each valve), are generic characters. *Hippagus* of Lea, long confounded with this genus, may prove to be a *Crenella* like *C. decussata.* I am pleased to be able to dedicate this species to the author who first brought order out of confusion in the complex synonymy of this genus ; who is, moreover, one of the first living malacologists.

Verticordia elegantissima n. s.

Euciroa elegantissima Dall, Bull. M. C. Zoöl., V. pp. 61, 62, July, 1878 (named but not described.)

Shell large, solid, frosty white externally, internally very pearly, inequilateral, slightly inequivalve, Cytherea-shaped, furnished with many scabrous, granulated, slightly elevated radiating costæ, of which one, forming the anterior boundary of the posterior fourth of the shell, is more prominent, and is indicated by a groove on the interior surface ; the sculpture in young shells consists of rounded granules between and irregularly over the costæ and small conical rough-surfaced spines arranged on the summits of the costæ, but these are usually rubbed down in adult specimens, after which the costæ (about fifty in number) and the secondary granulations become more evident ; lunule small, slightly impressed, with a comparatively smooth surface, the portion pertaining to the right valve (as usual in the genus) being about half the size of that forming part of the left valve, which latter (also as usual) is produced beyond the general plane of the margin, simulating a tooth ; beaks not very prominent, not coiled as in the typical species ; inner margin irregularly grooved, not denticulate ; in the left valve the wedge-shaped groove for the (wholly internal) ligament is separated by a projecting septum from the fossette for the right cardinal tooth ; except this septum be so considered, there are no teeth in the left valve ; right valve with a strong, stout, slightly anteriorly projecting tooth fitting into the fossette in the left valve and immediately under the beak ; the base of this tooth is supported by two buttresses, one with a concave surface extending forward under the lunule, the other opposite, shorter, and terminating under the cardinal margin, between which and its upper surface the ligament is inserted ; a little way within the posterior cardinal margin, and in general parallel with it, is a long slender tooth or lamina, which becomes obsolete in aged shells ; beside the ordinary marks of the adductor muscles as usually described, there are two smaller but very evident muscular scars, the pedal below the lunular buttress and the cardinal in the cavity of the beak. Lon. 13.25 ; alt. 10.1 ; max. diam. 8.0 mm., in an adolescent specimen ; one old valve measuring in lon. 30.0, alt. 23.0, and diam. 13.0 mm. approximately.

Station 16, 292 fms. ; Lat. 23° 7′ and Lon. 82° 43′ 30″ W., in 756 fathoms.

This elegant shell has quite a different aspect from the other *Verticordiæ*, and, misled by the the erroneous diagnosis in all the text-books, I referred it to a new group in my preliminary report, reserving a description until this conjecture could be verified by comparison and study. Now it seems to me that the characters are insufficient to justify its separation. The above description of the teeth is appropriate to all the recent species I have seen, or which have been well figured, except that in most of the species the cardinal tooth points upward or backward, and the posterior lamina is obsolete in some individuals of each species. It is by far the largest of the group, and only detached valves have been noted as yet.

Lyonsia bulla n. s.

Lyonsia bulla Dall, Bull., *loc. cit.*, 1878. (Not described.)

Shell delicate, iridescent, very thin, rounded, inflated ; sub-equivalve, but slightly produced and gaping behind ; surface covered with a delicate evanescent epidermis, which is raised into very fine short beards in radiating lines from the umbones ; these on the posterior third of the shell form rather distant, slightly elevated threadlike lines ; shell smooth, except that a faint impression of radiating lines is left by the epidermis ; beaks inflated ; basal margin arcuated ; anterior margin rounded ; posterior margin slightly produced, pinched, and truncated ; ossicle extremely minute (or none ?). Lon. 16.0 ; alt. 16.0 ; max. diam. 12.0 mm.

Lat. 24° 33′ N., Lon. 84° 23′ W., 1920 fms.

This has a curious superficial resemblance to the next species, except that it wants the granules.

POROMYA Forbes.

Poromya Forbes, Rep. Ægean Sea, p. 143, 1844. (*P. anatinoides.*)

This genus is clearly distinct from *Thetis* Sowerby (*T. minor*), which has an internal laminar buttress in the hollow of the beaks, although the two have been very generally united by authors, following the lead of H. and A. Adams. I do not feel sure that *Eucharis* Recluz is an exact synonym, though the name is several times preoccupied and must be given up. *Embla* Lovèn appears to be an exact synonym of *Poromya*. The pallial line is slightly sinuated in the latter, and there is a cardinal tooth only in the right valve, the ligament is almost entirely internal, and in the specimens I have seen there has been no ossicle. The group is closely related to *Neæra* and *Verticordia* by the shell characters.

Poromya granulata Nyst and West.

Thetis granulata Nyst and Westendorp, H. and A. Adams, Gen. Rec. Moll., II. 367, Pl. XCVII. figs. 2 *a*, 2 *b*.

Sand Key, 15 fms. ; Station 36, 84 fms. ; Station 32, 95 fms. (valve 19.5 high by 21.0 mm. in length) ; Station 45, 101 fms. (valve 16.0 high by 22.0 mm. long) ; Station 9, 111 fms. ; Station 5, 229 fms. Barbados, 100 fms. ; off Sombrero, in 45 fms. ; these two specimens belonging to the var. *triangularis*.

Having no specimens of the genuine *P. granulata* to compare, the determination is not absolute, especially as the figures of that species given by Adams and Jeffreys differ considerably among themselves, but the variation in form is considerable, as the above measurements show, and I feel little doubt that this is the true *P. granulata*. A form belonging to this genus has been insufficiently described by Jeffreys (under the name of *rotundata*) from one broken valve obtained in Lat. 56° 11′ N. and Lon. 37° 41′ W., in 1450 fathoms, on the *Valorous* cruise. Professor Verrill has amplified this description a little; but in consideration of the great variation in the form of the shell, number and distribution of the granules and their coarseness, visible in the specimens before me, I see no reason for considering the characters mentioned by Jeffreys as of importance enough to deserve a separate name. I note a very triangular variety from two localities, probably only an extreme variation of the type, which is covered with densely crowded very coarse subtubular granulations. These peculiar granulations, if they can be so termed, are apparently a feature common to a number of genera which are found in deep water. Jeffreys figures it in what he calls an *Axinus* (but which was referred to *Verticordia* by Seguenza); it exists in all the Verticordias, in species of *Neæra*, *Poromya*, and perhaps *Corbula*.

Poromya (?) granatina n. s.

This shell differs from *Corbula quadrata* Hinds * (P. Z. S., 1843, p. 57; Reeve, Conch. Icon., Pl. V. fig. 40, 1844) in form and proportions, but in many respects resembles that shell as figured. It is, however, of corbuloid form, having the ventral margin straight, the beaks more nearly central; it is not inflated and rounded like Hinds' species, but the posterior margin forms a sharp angle with the base at the intersection of the carina, which is very pronounced throughout its whole length, bounded by a shallow groove posteriorly, beyond which the whole shell is flattened as in *Hemicardium;* in the middle of this flattened area is a faint riblet bounding a small impressed lunule just behind the beak, which last is not prominent; cardinal tooth large and strong, directed laterally; shell anteriorly attenuated, perfectly white, proportionally more elongated than *C. quadrata* and covered with the fine sub-tubular granulations referred to previously. Lon. 10.0; alt. 7.0; diam. of right valve, 3.26 mm.

Yucatan Strait, 640 fms. (one valve).

If Recluz is correct in stating that *C. quadrata* has a cardinal tooth in each valve it will of course be distinct from *Poromya*; but a new name will have to be used,† since *Eucharis* is preoccupied in several departments. This, however, may well be left until the fact is determined. Reeve says nothing about the granulations on the surface of *C. quadrata*, but C. B. Adams states that all except the posterior third is granulated; in the present form the posterior part is granulated like the rest. As a single valve in good preservation is all that was obtained in this collection, the generic question cannot be yet determined, though the present form is probably quite nearly related to *P. quadrata*.

(?) Pandora oblonga Sowerby.

Pandora oblonga Sby., Hanley, Recent Shells, p. 49, Pl. X. fig. 46.

Charlotte Harbor, Florida, 13 fms.; Yucatan Strait, 640 fms.

Left valves of a species of *Pandora*, exactly resembling Hanley's figure of *P. oblonga*, were obtained at the above localities. Until the other valve is known it will not be practicable to refer them to their proper section of the genus. According to Carpenter, the type specimens of *P. oblonga* Sby. are lost, and no more are known. The present specimens may belong to another species; but they resemble the figure so closely, and do not so well agree with any of the Northern forms, that for the time it seems more desirable to allow them to remain provisionally under the name of *oblonga*. In Poulsen's catalogue of West Indian shells an undetermined species of *Pandora* is mentioned, which is doubtless the same as those obtained by the *Blake*. It is possible, however, that both may be referable to a form of the Mediterranean *P. rostrata*.

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* The type of *Eucharis* Recluz.

† There are several paleontological synonyms.

(?) Thracia phaseolina Kiener.

T. phaseolina Philippi, Moll. Sic., I., t. 1, fig. 7, 1836.
T. papyracea Jeffreys, Brit. Conch., V., Pl. XLVIII. fig. 4.

A single right valve about half an inch long, which seems referable to this species, was obtained in Yucatan Strait, at 640 fms.

Neæra ornatissima D'Orbigny.

Sphena ornatissima D'Orbigny, Sagra, Moll. Cuba, II. p. 286, t. XXVII. figs. 13–16 (1846).

Station 43, 339 fms.

Several specimens obtained as above appear to differ from the species figured by D'Orbigny only in size and in the greater proportional length and slenderness of the rostrum. As his specimens seem to have been young, it is probable that their proportions were not fully developed. The *Blake* specimens have about 25 to 28 radiating riblets, and an altitude of 4.0 mm., and a total length of 8.0 mm., of which the rostrum has 3.25 mm. To distinguish it, if necessary, it may take the varietal name of *perrostrata*. There are quite a number of fine radiating lines which are intercalated between the riblets and stray over part of the rostrum. These are not figured by D'Orbigny, but may have existed in his specimens nevertheless.

Neæra alternata D'Orbigny.

Sphena alternata D'Orbigny, *loc. cit.*, t. XXVII. figs. 17–20.

Station 36, 84 fms. Station 5, 152 fms.

Single valves, probably of this species, but with the anterior striæ or riblets finer and closer set, were obtained as above.

Neæra costellata (Deshayes) Philippi.

Corbula costellata Deshayes, Philippi, Moll. Sic., II. p. 13, Tab. XIII. fig. 9.

Station 5, 229 fms.

A left valve, measuring in lon. 14.0, in alt. 10.0, and 4.36 mm. in diameter, was collected at the above-mentioned locality. It has a strong resemblance to Philippi's figure above cited, but does not at all resemble the *costellata* figured in Jeffreys' Brit. Conch. (V., Pl. XLIX. fig. 3). It differs from Philippi's figure in having the radiating ridges continued over the acute rostrum and over the anterior third; it is also larger and more inflated, while the margin in front of the umbones is more produced and rounded. As I cannot at present untangle the synonymy, I propose to refer it, with the varietal name of *corpulenta*, to Philippi's species, which he rightly or wrongly called *costellata*.

Neæra granulata n. s.

Shell in form somewhat like G. O. Sars' figure of *N. glacialis* Sars, but more elongated. Sculpture of an indefinite, hardly perceptible, rounded ridge extending from the beak toward the lower angle of the rostrum, with a more definite one extending toward the anterior margin, which it slightly angulates, forming the boundary of a sort of lunule or impressed space in front of the beaks; beside these there are fainter or stronger concentric striæ or slight ridges extending toward the margin; lastly, the entire surface is more or less densely covered with minute opaque white granules, much as in *Poromya;* the granulations are obscurely radiately and concentrically arranged. Color dead white, beaks little prominent Teeth small, subobsolete; ventral margin rounded, anterior about the same; general appearance of the shell superficially much like *Leda minuta* Fabr. Interior very polished. Lon. 11.0; alt. 8.0; lat. 4.0; lon. of rostrum, which is not smooth, 3.3 mm.

Off Sombrero, 54 and 72 fms.; Barbados, 100 fms.

This is a very remarkable species, and not like any of those figured or described in the books.

Neæra rostrata Spengler.

N. rostrata Spengler, G. O. Sars, *loc. cit.*, p. 89, t. 6, fig. 7, a, b.

Barbados, 100 fms.; Station 36, 84 fms.; Sand Key, 80 fms.

Several large specimens were obtained which agree very fairly with Sars' figures.

Neæra Jeffreysi n. s.

Shell silky white, differing from *N. arctica* M. Sars, as figured (Moll. Reg. Arct. Norv., tab. 6, fig. 5) by the younger Sars, in being smaller, proportionately more elongated, the rostrum shorter and more pointed than in *N. glacialis* G. O. Sars, more turned up and more nearly midway between the ventral and the cardinal borders than *N. arctica;* shell inflated, with moderate beaks, on either side of which the dorsal margin lies very slightly incurved, instead of straight as in Sars' figures of *glacialis;* shell smooth, except for the distinct and very regular lines of growth; ventral margin a little produced in the middle, but on the anterior side rounded and sloping without any indentation at the intersection of the rostrum; there is no sculpture, — even the rostrum has no radiating lines. Interior smooth and polished; the process for the ligament is small, rounded, triangular, and projects downward directly from the tip of the beak, instead of being obliquely continued along the hinge margin, as in the above and most other species; a ridge runs along just below the anterior cardinal margin, as if the said margin had been pressed upward and outward from within; the space between the ridge and the margin is a little excavated. Lon. 15.0; alt. 9.5; maj. diam. 8.0; rostrum, (about) 5.0 mm. From the beak to the anterior margin is seven fifteenths, and from the tip of the rostrum to the line of the beak is eight fifteenths of the whole length.

Barbados, 100 fms. (young); Station 44, 539 fms.; Yucatan Strait, 640 fms.

I am glad to be able to dedicate this species to my friend Dr. Jeffreys, who has added a number of new species to this genus in his account of the mollusks of the *Valorous* expedition.

Neæra claviculata n. s.

Shell white, thin, translucent, polished, shining, covered with (about fourteen to the millimeter) numerous fine, regular, rounded, concentric undulations or narrow waves, fainter and more distant on the umbones; shape not unlike that of *Portlandia arctica* as figured by G. O. Sars (*op. cit.*, tab. 4, fig. 7 a), but shorter, more inflated, with the beaks more prominent and more directed forward, the posterior cardinal margin excavated instead of produced, and the rostrum itself more pointed and without the strong rib which characterizes this part in the Nuculid. Interior marginated more or less distinctly all round; spoon for the ligament small, posteriorly directed; from behind it, two thirds of the way toward the tip of the rostrum and broadening as it proceeds backward, extends a laminar buttress or "clavicle," lying within the marginal ridge and margin; beaks almost exactly midway between the two extremities of the shell; radiating sculpture none. Lon. 12.0; alt. 8.5; diam. (approx.) 6.5 mm.

Station 44, 539 fms. (one right valve). A fragment of which the sculpture resembled that of this species was obtained by Sigsbee off Havana, in 450 fms.

This species is remarkable for its abbreviated form, total absence of radiating sculpture, and singular clavicle. I have seen nothing of the latter kind in any species I have examined except this one.

Neæra sp. indet.

A fragment from off Cape San Antonio in 1,002 fms., somewhat resembling the last species in shape, but not in sculpture, indicates a rather large-sized form.

Neæra limatula n. s.

Shell of moderate size, thin, white, elongated, with the rostrum hardly differentiated from the rest of the valve; sculpture consisting of sharp-edged concentric ridges, hardly rising to lamellæ except posteriorly, covering the entire shell, averaging six to a millimeter but more crowded toward the basal margin and especially on the rostrum where they are also most elevated ; a single faint ridge extending from the umbo to the lower corner of the rather square-ended rostrum, which ridge is formed by a slight elevation of the lamellæ where they change from longitudinal to transverse following the lines of growth ; there is also a faint inward flexuosity in the lamellæ and basal margin in advance of this where the rostral indentation occurs in most species ; anterior cardinal margin gently rounded, anterior end rounded to the rather straight base which is hardly interrupted by the flexuosity above mentioned ; posterior cardinal margin rather concave ; rostrum rather squarely truncated, nearly straight ; within polished ; cardinal border thin ; ligamentary fossette extremely small, narrow, oblique, and not projecting within the margin.

Lon. 11.5 mm., of which 5.0 is forward from the line of the umbo ; alt. 5.0 ; diam. (approx.) 5.0 mm.

Station 44, 539 fms., one right valve.

This, from the descriptions, is clearly not one of the species obtained by Jeffreys, and is not like any of those figured by Sars or in the monographs.

Neæra arcuata n. s.

Shell very thin, white, polished, the basal margin evenly arcuated from the anterior end to the lower angle of the extremity of the rostrum ; anterior cardinal margin parallel with or hidden by the oblique anterior slope from the umbo ; posterior cardinal margin concavely arched ; rostrum short, somewhat recurved, roundly truncated at the tip, not differentiated by any riblet and with a very small triangular space of transverse wrinklings ; sculpture of rather distant (four to the millimeter) concentric flattened threads slightly sharper and more closely set toward the ends and quite faint on the umbo and in the middle of the shell ; intercalary lines of growth so faint as not to be perceptible ; there are some radiating opaque white color lines on the general translucent ground, but no radiating sculpture ; interior brilliantly polished ; margins very thin, not reflected ; ligamentary fossette oblique, small, narrow, projecting within the margin ; posterior extremity of the rostrum slightly inflated or twisted to the left. Lon. 12.5 (the umbo exactly in the middle of the shell) ; alt. 7.3 ; diam. (approx.) 5.5 mm.

Yucatan Strait, 640 fms., one left valve.

By its evenly arcuated base, want of differentiated rostrum, and peculiar sculpture, this species seems to be sufficiently distinguished.

Neæra lamellifera n. s.

Shell thin, inflated, not polished, white, short, and ornamented with about thirty-three thin sharp elevated and slightly reflected concentric lamellæ ; the lamellæ are separated by pretty uniform spaces marked with extremely fine and rather irregular lines of growth ; there are no radiating ribs, but on the transversely sculptured rostral area the lamellæ fail and are replaced by densely crowded, rather irregular and extremely fine wrinkles ; anterior cardinal margin arched ; posterior cardinal margin oblique, nearly straight ; anterior and basal margin rounded, with a strong sharp flexuosity differentiating the rostral part, which is also correspondingly compressed as compared with the inflated anterior part ; rostrum short, rounded at the end, not recurved ; umbo prominent ; interior smooth, with grooves corresponding to the lamellæ ; margins thin, sharp ; ligamentary fossette long, extremely narrow, reduced to a mere line parallel with the margin from which a barely perceptible corner projects inward. Lon. 12.5, of which 6.75 is posterior to the line of the umbo ; alt. 8.0 ; approximate diam. 6.25 mm.

Station 36, 84 fms., one right valve.

This also agrees with none of the described species so far as I have been able to discover, and is a particularly well marked form if the limited material be a fair representative of the usual characters of the species.

Corbula cubaniana D'Orbigny.

C. cubaniana D'Orbigny, Sagra, Moll. Cub., II. p. 282, Tab. XXVI. figs. 51–54 (1846).

Sigsbee, off Havana, in 100 fms. ; one valve probably of this species.

Corbula Barrattiana C. B. Adams.

C. Barrattiana C. B. Adams, Contr. to Conch., p. 237, 1852.

Off the west coast of Florida, in 30 fms. ; Station 21, 287 fms.

Two specimens probably of the above unfigured species.

Corbula Swiftiana C. B. Adams.

C. Swiftiana, C. B. Adams, Contr. to Conch., p. 236, 1852.

Sigsbee, off Havana, in 182 and 450 fms. ; off Sombrero, in 72 fms.

Specimens agreeing with Adams' diagnosis of his hitherto unfigured species were obtained in some numbers, especially at the first locality.

Corbula Dietziana C. B. Adams.

C. Dietziana C. B. Adams, Contr. to Conch., p. 235, 1852.

Off the west coast of Florida, 30 fms. ; off Sombrero, 72 fms. ; Barbados, 100 fms. ; Gordon Key, 68 fms.

Corbula disparilis D'Orbigny.

C. disparilis D'Orbigny, Sagra, Moll. Cub., II. p. 283, Tab. XXVII. figs. 1-4, 1853.

Off the west coast of Florida, in 30 and 50 fms. (fine large specimens); Station 12, 36 fms.; off Sombrero, 72 fms.; Station 36, 84 fms.; Barbados, 100 fms.; Sigsbee, off Havana, in 127 and 450 fms.; Station 2, 805 fms.

A well-marked species, with a wide range in depth, as the above record indicates.

Corbula cymella n. s.

Shell of somewhat the general character of *C. fragilis* and *C. scaphoides* (from the Pacific coast of Mexico and the Philippines respectively), but differing in proportions from either. Color whitish with a brownish tinge at the margins, internally with a glassy polish, externally dull; shell inequilateral, one third being anterior to the umbones; inequivalve, but not markedly so; anterior margin evenly rounded; ventral margin waved, slightly concave nearly opposite the beaks, then swelling, then again a little concave just before the posterior angulation; posterior hæmal margin straight, declining from the beaks to the first angulation, then obliquely straightly truncated toward the extremely acute posterior angle formed by the principal carina; beaks moderately prominent, flattened on top, not involute; from them a strong rounded carina extends to the tips of the shell, growing sharper posteriorly; another fine but very sharp carina extends from above the ligament close to and nearly parallel with the hinge margin, which its posterior termination slightly angulates; these form an extremely narrow concave lunule, while the space between these carinæ and the more prominent second pair of carinæ is distinctly excavated, and is crossed by the wave-like sculpture only near the posterior portion, the rest being nearly smooth, except for the extremely fine radiating lines, which are better defined here than elsewhere on the shell; these last cover the entire shell, and have not the appearance of grooves, they are visible only with a glass, and are best defined on the posterior face, as above mentioned, and in the furrows; other sculpture of about ten regular concentric waves, with wider and very uniform interspaces, which, however, in adults (as in all *Corbulæ*) begin to be crowded at the extreme margin; there is no anterior lunule or carina, the tooth is very slender and small, and the whole shell is very thin. Lon. 13.5; alt. at beaks, 7.5; max. diameter, 5.0 mm.

Gordon Key, in 68 fms.

This species is remarkable for its acuminated posterior end, and as very thin, nearly equivalve, ventrally slightly concave, and for its slender and elongated form.

Saxicava azaria n. s.

Shell having much the aspect of *Potamomya;* thick, of earthy texture, extremely inequivalve, marked with coarse irregular concentric ridges and growth lines, covered with a strong brown wrinkled epidermis, irregularly inequilateral ; left valve the smaller, with the posterior side shortest, right valve with the posterior side longest and strongly twisted to the left ; umbones very prominent, *Corbula* formed, anteriorly directed and greatly involute ; upper surface in front of them obscurely flattened ; from behind them two indistinct, irregular coarse ridges extend to the posterior end, which is obscurely rostrated and twisted to the left ; ligament coarse, stout, external ; cardinal margin perfectly edentulous, irregularly twisted ; other internal margins thin, smooth ; interior livid white ; muscular impressions irregularly broken and blotchy, as in *Saxicava* and certain species of so-called *Panopæa;* posterior end somewhat gaping. Lon. 25.0 ; alt. of larger valve, 22.0 ; diam. 16.5 mm.

This extraordinary shell, which has all the appearance externally of a gigantic irregularly twisted *Corbula*, was obtained by the U. S. Coast Survey Steamer *Bache*, twenty miles off Charlotte Harbor, Florida, in thirteen fathoms, April 19, 1872. Many of its peculiarities are doubtless merely individual ; but, allowing all that may be claimed on this score, it does not appear to even approximately resemble any other species of *Saxicava* known to science, although it pretty certainly belongs to that genus. It was alive when taken, but the soft parts were not preserved.

Modiola polita Verrill and Smith.

M. polita V. and S., Am. Journ. Sci., XX. p. 400, Oct. 25, 1880.

?*Mytilus luteus* Jeffreys' Rep. on French Expl. in the Bay of Biscay, pp. 5, 6 ; in Rep. Brit. Assoc. Adv. Sci., 1880.

Station 43, 339 fms., etc.

A species of *Modiola*, or perhaps of *Modiolaria ;* agreeing with the very brief diagnosis of Messrs. Verrill and Smith, as far as that goes, and with the habit of Dr. Jeffreys' undescribed *Mytilus* in forming a large nest, or mat, of byssus-threads, like most Modiolariæ ; was obtained at various depths and localities, reaching to very deep water, the largest specimens from the deepest water being over two inches in length. The depths are not given in Dr. Jeffreys' paper. Prof. Verrill's specimens were from 238 fathoms.

Crenella decussata Montague.

C. decussata Sars, *op. cit.*, p. 31, Tab. 3, fig. 4, 1878.

Nuculocardia divaricata D'Orbigny, Sagra, Moll. Cub., II. p. 311, Tab. XXVII. figs. 56–59 (1846).

Barbados, 100 fms. [Alaska, California, New England, British Seas, Norway, etc.]

This little shell has a wide distribution; the farther north it is found, the larger it grows. Some Arctic specimens measure 12.5 mm. in height; these, about one tenth as much, or $\frac{1}{1000}$ of the size of the former. There is no doubt as to its identity with D'Orbigny's *Nuculocardia.*

Modiolaria sp. indet.

Yucatan Strait, 640 fms., one dead valve.

Mytilus exustus Linne.

Mytilus exustus Linne, D'Orbigny, + *M. Lavalleanus* D'Orbigny + *M. Dominguensis* D'Orbigny, *loc. cit.*, Tab. XXVIII.

Sigsbee, off Havana, 158 fms.; Barbados, 100 fms., etc.; thence to shallow water.

Avicula sp. indet.

Station 26, 116 fms., dead, perhaps washed from shoaler water.

Amussium lucidum Jeffreys.

Pleuronectia lucida Jeffreys, Depths of the Sea, p. 464, fig. 78.

Station 2, 805 fms.; Station 21, 287 fms.; Yucatan Strait, 640 fms.; Station 5, 229 fms.; Station 35, 804 fms.; Station 3, 243 fms.; Station 19, 310 fms.; Station 47, 331 fms.; Sigsbee, off Havana, in 119, 127, 243, 450, and 480 fms.; off Morro Light, 292 fms.; Station 7, off Cape San Antonio, 424 fms.; Station 44, 539 fms.; Gulf of Mexico, west of Florida, 30 fms.; Charlotte Harbor, Florida, 13 fms.

This is one of the most common and pretty of the abyssal species in the Antillean and Gulf region. Variety *marmoratum*, from all depths, is beautifully mottled with scarlet, opaque white, and orange; many specimens are dotted all over with opaque white dots. I have reason for suspecting that this, or a nearly allied species, attains a much greater size, perhaps two or three inches in length. It will be observed that the ordinary form ranges from a few fathoms on the coast of Florida to the greatest depths of the region; and there is no difference whatever between the specimens from shallow and those from deep water. The same may be said of *Gouldia cubaniana.*

Pecten sp. indet.

A fresh valve of a small, aculeately sculptured, scarlet *Pecten* was obtained from 804 fms.

Spondylus sp. indet.

Young specimens and one adult valve of a pink striated *Spondylus* were obtained from 640 fms. in the Yucatan Strait.

Lima caribbea (?) D'Orbigny.

In Yucatan Strait, at a depth of 640 fathoms, a valve was obtained, which may perhaps belong to this species.

Lima sp. indet.

A very young valve, nearly smooth, and equilateral, was obtained from 805 fathoms at Station 2.

Limatula ovata Jeffreys.

Lima ovata (Wood) Jeffreys, Ann. Mag. Nat. Hist., Nov. 1876, p. 426.

A single valve with rather prickly imbricated sculpture on the ribs, a plain hinge-line and no furrow, was obtained by Sigsbee in 450 fms. off Havana. This unfortunately crumbled under handling, but may very probably be referred to the species quoted by Jeffreys under the above name.

Pectunculus variegatus (?) D'Orbigny.

? *P. variegatus* D'Orbigny, Sagra, Moll. Cub., II. p. 314.

Station 56, 888 fms.

A single pair from the above locality may belong to the species above mentioned, which is the *P. castaneus* of Lamarck.

It is hoped that in the final report this and other doubtful species will be definitely recognized, — a labor often taking a disproportionate amount of time compared with the result obtained and which could not be at present spared.

Limopsis aurita Brocchi.

Arca aurita Brocchi, Conchyl. foss. subapp. II. p. 485, Tab. XI. fig. 9.
Limopsis aurita Jeffreys, P. Z. S., 1879, p. 585.

Gulf of Mexico, west of Florida, 30 fms.; Station 36, 84 fms.; Station 20, 220 fms.; Gulf Stream, 447 fms., Pourtalès.

Limopsis tenella Jeffreys.

L. tenella Jeffreys, Ann. Mag. Nat. Hist., Nov. 1876, p. 433.

Station 44, 539 fms.; Station 41, 860 fms.; Station 56, 888 fms.; Station 33, 1568 fms.

Limopsis minuta Philippi.

Pectunculus minutus Philippi, En. Moll. Sic., I. p. 63, Tab. V. fig. 3; II. p. 45.
Limopsis borealis Woodward, Sars, etc., *teste* Jeffreys.

Gulf of Mexico, west of Florida, in 30 fms.; Station 36, 84 fms.; Barbados, 100 fms.; Bache, Apr. 22, 1872, Lat. 21° 14′ N., 100 fms.; Sigsbee, off Cuba, 119 fms.; Station 20, 220 fms.; off Morro Light, 292 fms.; Station 19, 310 fms.; Sigsbee, off Havana, 450 fms.; Yucatan Strait, 640 fms.; Station 2, 805 fms.

The teeth in this species vary from six to eleven ; the proportional width of the hinge-line, obliquity of the shell, etc., are most variable.

Limopsis cristata Jeffreys.

L. cristata Jeffreys, Ann. Mag. Nat. Hist., Nov. 1876, p. 434.

Yucatan Strait, 640 fms.

Several detached valves, probably of this species, which seems to be a well-founded one.

Limopsis antillensis n. s.

Shell small, moderately thick, rather inflated, inequilateral, shovel-shaped, short, elevated ; hinge-line straight, with a narrow quadrangular area, in the middle of which is a narrow space scooped out triangularly in each valve for a ligament ; anterior margin nearly perpendicular to the hinge-line, gently rounding into the evenly rounded base ; posterior margin obliquely truncate, the truncation extending nearly to the base and being bounded by a straight or slightly concave line ; at the point where the truncation rounds into the base the interior shows three or four particularly strong ridges rising to small tubercles just within the margin ; hinge teeth six in each valve ; from just in front of the cartilage pit three teeth extend forward enlarging progressively, the anterior tooth considerably the largest, all perpendicularly placed with regard to the cardinal margin, long and rather slender in the young, stouter and more obtuse in the older shells ; behind the cartilage-furrow or pit the hinge is edentulous for a little space, then bears three teeth, one below the other, nearly parallel to the hinge margin, the largest uppermost, the smallest being the last in the series ; inner margin lightly crenulate, crenulations most evident toward the basal angles, where also traces of internal radiating riblets are visible, of which the tubercles form the terminations; sculpture of close-set, rounded, concentric ridges with a greater or lesser number of fine radiating distant raised threads intersecting them, most evident in the furrows but not greatly breaking the continuity of the concentric sculpture; color white; several specimens show a pink color-ray in the posterior portion, one is wholly a bright lemon-yellow, but most are waxen white ; shell inflated, beaks not very prominent ; epidermis short except on the radiating lines, light brown, altogether rather sparse. Lon. 3.5 ; lat. 4.25 ; diam. 2.5 mm. Length of hinge line, 2.25 mm.

Sigsbee, off Havana, 80 fms.

The peculiarities of the hinge appear to be only specific characteristics, and from *Limatula* through various forms of *Limopsis* to *Glomus*, *Silicula*, and *Arca* the hinge offers a series of easy transitions. The peculiar hinge, the "keystone" shape, the character of the tuberculation, and the small size, are the chief characteristics of this little shell, which is perhaps alone in the group in showing traces of bright coloration.

Macrodon asperula n. s.

Shell small, white, slightly inequivalve, excessively inequilateral, byssiferous ; with a thin brownish epidermis radiatingly streaked with thicker lines which fray out into hairs, the whole being very fugacious ; hinge-line straight, the area long and narrow, the beaks situated just within the anterior third of the line ; ligamentary area extremely narrow, beginning under the beak, extending close under the posterior areal carina obliquely to the posterior third of the hinge-line, where it first reaches the margin, flat, black, with several white longitudinal striæ ; beaks well marked, not very prominent, with a faint depression extending from them to the basal margin, marking the position of the byssal gape ; outline like that of Philippi's *Arca aspera* (Philippi, *op. cit.*, II. Tab. XV. fig. 1 *c*), but much more inequilateral, the anterior end being smaller, the posterior larger and more extended, and the line of the base much more oblique, as would naturally follow from the above circumstances ; sculpture of about a dozen (excluding those on the beaks) concentric sharp-edged subimbricate ridges, being old margins of the shell as it were forming varices, fainter and more close set on the beaks ; with strong rounded radiating riblets (near the base about four to a millimeter) continuous only from one varix to another ; posterior part of the cardinal border somewhat auriculated or compressed, anterior extreme rounded or moderately inflated, the anterior margin forming a little less than a right angle with the hinge-line, the posterior a little more than a right angle, the former slightly rounded to the base, where it is a little concavely excavated for the byssal gape, the latter first a little concave from the auriculation, then very broadly rounded out and passing without any angle into the base ; right valve a little the smaller ; interior white, both muscular scars double (by the splitting of the ends of the adductors) ; margin smooth, sharp ; byssus slender, tufted at the distal end, light brown ; hinge with six vertical teeth extending from the position of the beaks anteriorly, the first four small, vertical, gradually enlarging forward, the fifth largest, and with the sixth somewhat oblique ; hinge between the beak and the ligamentary furrow edentulous, beyond that there are three horizontal teeth, the middle one largest extending posteriorly nearly parallel to the hinge-line and to each other. Lon. 8.5 ; alt. 5.0; max. diam. 3.25 ; lon. of hinge-line, 6.25 mm.

Station 33, 1568 fms., living; Station 19, 310 fms; Cape San Antonio, 1002 fms.

This is one of the most interesting of the *Arcidæ* obtained by the expedition. The type of the genus (Lycett, 1845) is a fossil of the lower Oölite, but there seems no reason for separating the recent shell from it generically or sectionally.

Arca pectunculoides Scacchi, var. **orbiculata.**

A. pectunculoides Scacchi, Notizie, etc., p. 25, Tab. I. fig. 12, 1833.

Sigsbee, off Havana, 480 fms; station 33, 1568 fms.

The specimen from deeper water was nearly round, except for the slightly auriculated cardinal margin; the teeth were also proportionally more distant and less strong, the exterior nearly smooth. I suspect it to be different, but until further material be available, refer it to this species as a variety *orbiculata*. I can only account for Prof. Verrill's suggestion that this species and *Arca glacialis* are the same, and that Sars' figure of the variety *septentrionalis* represents a deformed specimen,* by the supposition that the Professor had no specimens of the genuine *A. glacialis* for reference. It appears to me not only that they are very distinct, but that many authors would be tempted to put them in different sections of the genus. Apropos of this, the reference of these small species to *Cucullæa* by Dr. Jeffreys will hardly be accepted in view of the characters of the type of Lamarck's genus, which materially differ from those of the forms now under consideration. In this species sometimes the radiating sculpture almost fails, at other times is very strong; the margin is sometimes lightly notched on the edge, but is smooth within the edge; in the middle of the hinge margin is an edentulous space, and all the teeth are more or less oblique.

Arca glomerula n. s.

Shell similar in general shape, size, and sculpture to *A. pectunculoides*, but shorter and higher, with a perfectly different hinge, and bearing much the same relation to that species that *Limopsis minuta* does to *L. aurita*. The external concentric sculpture is the most enduring, and is always preserved, while the radiating sculpture, sometimes strong, is often evanescent; the radiating sculpture always appears inside the shell within the margin (which is smooth and polished) in a series of small ridges, generally with the same level as the rest of the interior, but sometimes rising into little tubercles, and separated by rather deep, short, narrow depressions, which do not extend far inward nor over the smooth margin; hinge straight, with from fifteen to seventeen stout nearly vertical teeth, usually in a continuous series; an occasional specimen shows a gap in the middle through the atrophy of one of the small central teeth; those at the ends of the series are oblique, as usual, but the series itself forms a straight line. In *A. pectunculoides*, on the contrary, all the teeth are oblique and very much more slender; there are usually only five or six at each extremity of the hinge-line, and the middle part is either quite edentulous or only lightly irregularly granulous. *A. glomerula* measures as follows: lon. 5.75; alt. 5.0; diam. 5.0; lon. of hinge-line, 4.25 mm. A specimen of *A. pectunculoides* measures: lon. 7.75; alt. 7.5; diam. 5.5; lon. of hinge-line, 6.25 mm.

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* Proc. U. S. Nat. Mus., 1881, p. 401.

Barbados, 100 fms.; Bache, April 22, 1872, lat. 21° 14′, 100 fms.; Station 20, 220 fms.; Station 19, 310 fms.; Sigsbee, off Havana, 450–480 fms.

Considering the great variability of abyssal shells it is possible this may eventually rank only as a variety of *A. pectunculoides*, but with the material at hand I cannot see the way clear to unite them at present.

Arca polycyma n. s.

Shell small, rounded quadrangular, slightly inequilateral, nearly equivalve, moderately evenly inflated, whitish, with little or very fugacious epidermis; sculpture very remarkable, consisting, first, of very even, broad, rounded, regular, concentric waves (twelve or thirteen in number), separated by sharp, deep grooves. In dead or worn shells these waves are smooth, or nearly so, but in perfectly fresh (and especially young) shells on the surface of the broad slightly flattened waves may be seen what look like two rows of subcylindrical, slightly irregular grains of sand, arranged side by side, with their longer axes radiating from the beak; these granules, if so they may be termed, are really hollow, and are the thinnest possible bubbles of shelly matter which leave, when rubbed off by any slight friction, a couple of zigzag slightly elevated lines where their bases were fixed to the shell; a very slight friction will obliterate this, and then the shell will be nearly smooth. The hinge area in each valve is elongated and narrow; the narrow furrow for the ligament goes straight across to the margin from the beak (which is nearly opposite the middle of the hinge-line) instead of obliquely, as in the last-mentioned species. The anterior, posterior, and basal margins are all evenly rounded, and the surface evenly convex; the beaks not at all prominent; the margin is perfectly smooth; the interior is undulated to correspond with the exterior, though the shell is pretty solid and thick in proportion to its size; muscular impressions distinct; hinge with seven to nine smooth teeth in advance of the ligamentary furrow and ten or eleven behind it; middle teeth vertical, small; those at the angles of the shell somewhat oblique and larger; there is no marked gap in the middle of the series, and the teeth are strong broad and not striated. Lon. 9.75; alt. 6.0; max. diam. 5.0; lon. of hinge-line, 6.0 mm.

Barbados, 100 fms.

This shell has a sculpture unlike any other in the genus of which I can find any description. It may be of a similar nature to the "granules" of *Poromya*, but the "bubbles" project much more from the surface and have a very different aspect from the tubular or honeycomb-like surface of *Poromya*.

Nucula tenuis Montague.

Nucula tenuis Forbes and Hanley, Brit. Moll., II. 223, Pl. 47, f. 6.

Sigsbee, off Havana, 175 and 450 fms.; off Morro Light, 292 fms.; Station 20, 220 fms.; Station 3, 450 fms.

These specimens agree very well with British and some Arctic specimens of *N. tenuis*, although the waters in which they live are many degrees warmer and perceptibly salter than those of the North.

Nucula crenulata A. Adams.

Nucula crenulata A. Adams, P. Z. S., 1860, p. 52. Hanley, Mon. *Nuculidæ*, Pl. IV. figs. 134, 135 (Guadaloupe).

Twenty miles west of the Florida coast in 30 fms.; Station 36, 84 fms.; Barbados, 100 fms.; Sigsbee, off Havana, in 158, 182, and 450 fms.; Station 20, 220 fms.; Station 19, 310 fms.; Yucatan Strait, 640 fms. Variety *obliterata*: Station 44, 539 fms.; Yucatan Strait, 640 fms.; Station 2, 805 fms.

There seems to be little doubt that this is Adams' species, though uniformly more trigonal than Hanley's figure of the same from the unique type. Most of them have very strong sculpture, which is irregular. The teeth are 9 anterior, 15 posterior, with a well-marked cartilage pit. In the variety *obliterata* the shell is higher and still more triangular; teeth, 8 anterior, 12 posterior; and the sculpture almost entirely obsolete, the radiating striæ least so.

Nucula cytherea n. s.

Shell with nearly the outline of *Tapes virgineus*, as figured by Jeffreys (Brit. Conch., Pl. XXXIX. fig. 5), but with the beaks higher and more central and the anterior end more broadly rounded; color pale straw-color or white, beautifully polished, with no radiating sculpture; concentric sculpture of regular rounded waves, as in *Liocyma*, of which there are about forty, finer and closer on the beaks, with a tendency to become obsolete at the anterior basal portion of the shell; shell evenly convex; beaks well marked, but not prominent; inner margin not crenulate; anterior teeth 12–14; posterior teeth 25–27, all slender, long, comblike, and not ⊳-shaped; ligamentary fossette or pit extremely minute, so that the series of teeth is practically continuous. Neither lunule nor escutcheon is visible, nor can they be said to exist in this species; interior polished, white, not perceptibly pearly, but having a sort of opaline lustre when viewed in a strong light. Lon. 8.6; alt. 6.75; diam. 5.0 mm.

Off Cape San Antonio, 413–424 fms.; Yucatan Strait, 640 fms.

This species is beautiful and remarkable both in form and sculpture. I have not found any *Nucula* of this shape figured anywhere or described in modern publications on the recent or fossil species of the group. It would perhaps be referred to the section *Tindaria*.

Leda jamaicensis D'Orbigny.

Leda jamaicensis D'Orbigny, Sagra, Moll. Cub., II. p. 263, Pl. XXIV. figs. 30–32 (1846).
Leda unca Gould, Proc. B. S. Nat. Hist., VIII. p. 282, 1862; Verrill, Proc. U. S. Nat. Mus., Jan. 1881, p. 401.
? *Leda* (*Lembulus*) *lamellicostata* Seguenza, Studi form. plioc. 1877; Nuculidi terz., p. 1173, Tav. II. figs. 10 *a–c*.

Sand Key, 80 fms.; off Sombrero, 54 and 72 fms.; Yucatan Strait, 640 fms.; Jamaica, Santo Domingo (D'Orbigny); North Carolina (Gould); off Southern New England, 85–155 fms. (Verrill).

Specimens obtained as above appear to be referable to D'Orbigny's species. As between Northern and West Indian specimens of this shell the only differences are those of texture, as usual in shells having such a distribution. There is little doubt that of the minute shells described by Seguenza and Jeffreys a certain proportion are merely the young of larger forms, and the slight differences of contour and number of teeth do not necessarily indicate equal differences in the adult state. The amount of sectional, subgeneric, generic, and subfamily divisions instituted by some authors in this group seems to me largely in excess of the needs of science and of valid characters in the creatures themselves.

Leda messanensis Seguenza.

Leda acuminata Jeffreys, An. Mag. Nat. Hist., p. 69, July, 1870.
Leda (*Junonia*) *acuminata* Seguenza, Nuc. terz., p. 1175, Tav. III. figs. 15 *a–e*. (Not *L. acuminata* Von Buch, nor of Eichwald.)
Leda messanensis Seguenza, MSS. (not *Neilo messanensis* S.), *loc. cit.*, *supra*. Jeffreys, P. Z. S., June 17, 1879, p. 576, 1880.

Station 19, 310 fms.; Station 20, 220 fms.; off Cape San Antonio, 1002 fms.; Barbados, 100 fms.; Sigsbee, off Havana, 450 fms.

Chiefly distinguished by the strength of its sculpture and its greater inflation from the young of the preceding, but is placed by Seguenza in a different subgenus or section.

Leda Jeffreysi Hidalgo.

Leda lata Jeffreys, An. Mag. Nat. Hist., Nov. 1876, p. 431; not of Hinds, Voy. Sulph., 1845.
Leda Jeffreysi Hidalgo, Moll. Hisp. etc. Jeffreys, P. Z. S., 1879, p. 579, Pl. XLVI. fig. 2.

Station 33, 1568 fms.

The shell which I refer to the above species is more quadrangular than Jeffreys' figure, the longer end descending more obliquely from the beak and therefore more pointed; a much larger proportion of the shell is behind the beaks, the anterior end is more pointed, and the basal margin, instead of being rather evenly arcuated, is particularly produced in the middle just behind the vertical line of the beaks. It has six teeth before and eight behind the beaks, and is about five millimeters in length. It does not exactly agree with any of the figured species, recent or fossil, and is most like Philippi's figure of *Nucula glabra*, if the relations of the parts were exactly reversed, anterior for posterior, etc. It may take the varietal name of *quadrangularis* until more material comes to hand, and may eventually prove to belong where I provisionally place it, among the varieties of *L. Jeffreysi.*

Leda dilatata Philippi.

Nucula dilatata Phil., En. Moll. Sic., II. p. 47, Tab. XV. fig. 7, 1844.
Neilo dilatata Seguenza, Nuc. terz., p. 1184, 1877.

Off Morro Light in 292 fms.

This shell agrees exactly with Philippi's figure and description, but it is not a *Neilo*, the ligament being as usual in *Leda* and *Yoldia.*

Leda Carpenteri n. s.

Shell resembling in outline and size *Leda hamata* Carpenter, as figured by Reeve in the Iconica (Pl. IX. fig. 56), but with the rostrum less recurved. It differs from that species in being thinner, anteriorly more pointed, in wanting the strong epidermis, concentric ridges, and sharp rostral carinæ. It is nearly smooth, except for lines of growth, with a thin greenish polished epidermis; a ridge bounding the escutcheon proceeds from the inconspicuous beaks to the dorsal angle of the rostrum; the umbones hardly rise above the dorsal margin, which pouts before and behind them, but hardly gapes; an internal ridge passes from the tip of the rostrum well into the umbonal cavity in most specimens. Teeth, anterior 8–16, posterior 20–25. Lon. 10.5; alt. 5.0; diam. 2.5. mm.

Barbados, 100 fms.; Station 21, 287 fms.; Station 5, 229 fms.; Station 9, 111 fms.

I have not been able to compare a figure of *L. clavata* Calcara, which is an Italian fossil, apparently of somewhat this shape. A long search has not revealed a figure or description of any recent species applicable to the form before me, whose smoothness is remarkable.

Leda (Neilonella) corpulenta n. s.

Shell nearest to *L. cœlata* Hinds, which is more deeply concentrically sulcated, with the rostral area smooth, or with a smooth bounding ridge, while in *L. corpulenta* the striæ and intervening finer ridges are carried clear over the shell to the dorsal margin. The present species is more inflated, with a more convex basal margin, with the beaks a little more anterior, both ends more rounded, especially the posterior end; in *cœlata* the lunular areas are defined by deep grooves or ridges and dissimilar sculpture, in *corpulenta* they are so faintly defined as to be nearly invisible; *corpulenta* has about fifteen teeth on each side of the beak, which is not inclined; in *cœlata* there are about fifteen posterior and twenty anterior teeth, and the beak is posteriorly inclined; the ligament in the latter is wholly internal, in *corpulenta* it extends equally on each side of the beak external to the dorsal margin, is about 2.0 mm. long, black, and when weathered away in detached valves exhibits a flattened area beneath each beak with a little pit in the centre, which last usually retains a particle of ligament, simulating an internal ligament. Shell with a light olive polished epidermis, porcellanous, extremely inflated, the young proportionately longer and less rounded. Lon. 9.5; alt. 6.0; diam. 5.0 mm.

Station 23, 190 fms.; Station 21, 287 fms.; Station 47, 331 fms.; Sigsbee, off Havana, 450 fms.

Some things seem to indicate that the young have the cartilage wholly internal, but this is not certain, as the apparent young may belong to a different species. Except the difference of the ligament, however, there seem to be no differential characters between them.

This species does not gape at all. The epidermis is polished. The ligament is central, not at one side of the beaks as in *Solenella* and the typical *Neilo*. The latter, as hitherto defined, will not admit it, nor will typical *Leda*. I regard it as one of the links which knit together the assemblage of the *Nuculidæ* in a network of ramifying relationships. Should it be thought worthy of a name it may be called *Neilonella*, and it is certainly far more distinguishable than many groups which have been named and segregated by Bellardi and others.

Leda vitrea (?) D'Orbigny, var. **cerata.**

L. vitrea D'Orbigny, Sagra, Moll. Cuba, II. p. 262, Pl. XXVI. figs. 27–29 (1846).

Barbados, 100 fms.; Sigsbee, off Havana, 450 fms.

I am not sure that these shells should be referred to D'Orbigny's species. They are more obtuse at the posterior end; the sculpture is strong only over the basal middle part, elsewhere it and the carinæ about the lunule and escutcheon are obsolete. It may take the varietal name of *cerata* (from its peculiar whitish lustre) for the present, or until more material can be examined, or a comparison made with typical specimens of D'Orbigny's species. The general features, except those above noted, are very similar to those of the shell he figures, and these specimens reach a length of 6.5 mm.

Leda solida n. s.

Shell almost equilateral, with the beaks inclined a little backward, stout, solid, smooth, except for rather well-marked lines of growth; anterior end broadly rounded; posterior end more pointed, but not carinated, sulcated, nor produced; base roundly arcuated; anterior dorsal slope slightly convexly rounded; posterior slope a little excavated or concave; lunule and escutcheon indistinct or none; teeth, anterior 17, posterior 11, ligamentary fossette unusually large, triangular. Lon. 12.5; alt. 6.6; diam. 4.5 mm.

Station 21, 287 fms.

The general form of this species is not unlike that of *L. chuva* Gray, but the rostrum is not so curved or differentiated from the remainder of the shell, and it is not sculptured. I have sought in vain for any figure sufficiently similar in outline to form the basis of a critical comparison.

Leda intermedia Sars.

Portlandia intermedia M. Sars; G. O. Sars, Moll. Reg. Arct. Norv., p. 38, Tab. 4, fig. 9, 1878.

Station 2, 805 fms.

This is identified from Sars' figure, above cited. The North Pacific species, mentioned by Jeffreys (P. Z. S., 1879, p. 578), seems to me to differ from it but slightly, if at all.

Yoldia solenoides n. s.

Shell thin, elongate-oval, gaping at both ends; smooth, or marked by a few shallow concentric grooves or flattened ridges about the middle toward the basal part, elsewhere obsolete or absent; shell whitish, rather pearly; epidermis iridescent, thin, dehiscent; basal and dorsal margins nearly parallel; beaks very inconspicuous; lunule and escutcheon extremely narrow, marked by a narrow elevated thread and a groove on each side of the slightly pouting margin; anterior and posterior ends nearly equal, similar, bluntly rounded; anterior teeth about 18, posterior 22; ligamentary fossette large; lon. 12.5; alt. 6.0; diam. 3.5. Beaks situated 6.5 mm. from the anterior end.

Station 49, 118 fms.

This shell looks like a *Solenella;* but the ligament is distinct, and it is perfectly internal.

Yoldia liorhina n. s.

Shell thin, moderately large for the genus, light greenish waxen, clouded with a smoky tinge in some specimens on the convexity of the valves; inside shining, not pearly; outside polished, brilliant, moderately inflated; beaks nearest the anterior end of the shell, little prominent; sculpture consisting of rather numerous (about five to a millimeter) concentric grooves, with much wider interspaces, more crowded and fainter toward the beaks, extending from the anterior dorsal margin parallel with the lines of growth to the (rather faint) rostral flexure at the posterior part of the shell, where they rather abruptly cease, and the remainder is extremely smooth and polished; lunule and escutcheon very narrow, bounded externally by grooves, inside of which is a raised thread, the space between groove, thread, and margin being somewhat excavated; shell gaping at both ends; anterior end rounded, base broadly arcuated, posterior end very obtusely pointed; angle between the anterior and posterior dorsal margins very obtuse; beaks hardly rising above the margin; anterior teeth thirteen, posterior seventeen, distinctly marked, with some four or five obscure ones on each side near the beak; ligament large, inserted under the beak, instead of on a little shelf as usual. Lon. 13.1; alt. 7.5; diam. 4.75 mm. Beak behind the front, 5.0 mm.

Sigsbee, off Havana, 182 fms.; Station 23, 190 fms.; Station 33, 1568 fms.

This species belongs to the group of *Yoldia lanceolata* Sowerby, *Y. seminuda* Dall, etc.; but I have not found any description or figure which would seem to apply to it. It is perhaps most like *Yoldia nicobarica* Spengler, as figured by Hanley (Mon. Nuc., Pl. I. fig. 7), but is less equilateral and less recurved behind, beside being sculptured.

GENUS GOULDIA C. B. ADAMS.

< *Gouldia* C. B. Adams, Cat. Coll., p. 29, 1847. Dall, P. Z. S., Feb. 1879, p. 131.
< *Thetis* C. B. Adams, Proc. Bost. Soc. Nat. Hist., p. 9, 1845, *non* Sowerby.
< *Lioconcha* Mörch, Cat. Yoldi, pt. ii. p. 26, 1853.
Circe E. A. Smith, P. Z. S., 1881, p. 489, *non* Schumacher.

The genus *Gouldia* was instituted by Prof. Adams in 1847, as pointed out lately by the writer in the Proceedings of the Zoölogical Society. More lately Mr. E. A. Smith, of the British Museum, has shown that the genus, as constituted and as generally used, contains two very different types of shell, one belonging to that group of *Veneridæ* of which *Circe* Schumacher is the leading type, and the other to the *Crassatellidæ*. While desirous of bearing testimony to the general accuracy of Mr. Smith's comments on the subject, and to the obligation under which he has placed us in setting forth the facts clearly, I must beg leave to question two of his conclusions, first, that the genus is untenable, and, secondly, that Prof. Adams' specific names are to be supplanted by those of D'Orbigny.

The genus contained two species, both new; the first, *G. cerina*, essentially similar to the *Venus minima* Montague, of Britain; the second, *G. parva*, a minute Crassatellid belonging to the sub-genus or section *Eriphyla* Gabb. The specific names of Prof. Adams date from 1845, those of D'Orbigny from 1846, according to his own claims, which were never any too modest in matters of priority, while the Mollusques de Cuba in which they are figured (and which in itself bears no evidence of their having been elsewhere described, except the date 1846 after the specific name) was published in 1853, instead of 1841, as Mr. Smith has it.

The genus *Circe* was described by Schumacher in 1817 with *Venus scripta* L. as the type. From this the shells of the type of *Gouldia cerina* are very different. We do not know the animal of *Circe*, but on conchological grounds alone there are abundant reasons for separation if the practice of Mr. Smith and other modern naturalists with regard to genera in general be taken as a criterion. Under the Linnean or Lamarckian system they would of course be united; but with that we have nothing to do. The *G. minima* was figured by the brothers H. and A. Adams as an example of the genus, and was taken as the type by Stoliczka, who notes its resemblance to an *Astarte* (Cret. Pelyc. India). Prof. Adams mentioned no type, but *G. cerina* was his first species. Other naturalists have judged the genus by the specimens they happened to possess, or were puzzled if they had representatives of both. However, Carpenter, in 1857, as noted by Smith, pointed out that the Crassatelloid types must be eliminated from *Gouldia.* In 1853 Mörch proposed, without a diagnosis, the genus *Lioconcha* for shells formerly included under *Circe,* but inflated and smooth, or concentrically ribbed, and practically identical with *Gouldia*, as restricted here. The type *L. castrensis* belonged to the smooth series; as Stoliczka points out, *Lioconcha* may be conveniently separated into two sections, in which case *Gouldia* might be restricted to the concentrically sculptured forms, and *Lioconcha* preserved for the smooth ones. If this be thought too refined a distinction, *Gouldia,* having eight years' priority and a Latin diagnosis, will take precedence, and *Lioconcha* (which has been generally adopted) must be suppressed. The little *Crassatella*, included with *G. cerina* by Professor Adams, represents a group, which has been discussed by several writers, Meek among the number, and to which several names have been applied. It is rather numerous in species, and they are very uniform in facies, proportions, and general character. They differ from the typical *Crassatella* chiefly in form, in the elongation and more distant location of the lateral teeth, their usually unequal valves, and in their uniformly small size. These are not important characters, and the group can at best form but a subordinate section of *Crassatella ;* yet the preservation of Gabb's name of *Eriphyla* for the group would not be without a certain convenience.

A word in regard to the error of combining forms belonging to such different groups may serve to throw a little light on the subject. Prof. Adams' original types of *G. parva* were detached valves which had lost their ligament, as also had his (two) specimens of *G. cerina.* In this condition the cartilage pit preserves little trace of its office, and it is really not very easy to point out any marked difference in the two hinges which, by itself, would separate them more than specifically. The error, with the specimens before one, is really not so surprising as it might seem.

Gouldia dilecta, as surmised by Mr. Smith, belongs to the typical group; *G. australis* I do not know, but there are many more species of various sizes included in collections usually under the name of *Lioconcha.*

Gouldia cerina C. B. Adams.

Thetis cerina C. B. Adams, Proc. Boston Soc. Nat. Hist., Jan. 1845, p. 9.
Gouldia cerina C. B. Adams, Cat. of Coll., p. 29, 1847. (Jamaica.)

Charlotte Harbor, Florida, 13 fms.; Barbados, 100 fms.; Station 5, 229 fms.

Shell with nebulous fluctuating color markings, developed into distinct lines on the lunule and escutcheon, purplish inside in some specimens. The ligament is as much external as in any of the *Veneridæ*, and cannot be said to be semi-internal any more than in *Saxidomus*, for instance. The hinge is composed of three diverging cardinal teeth, the middle one largest, that nearest the lunule slender, and sometimes almost obsolete. A tolerably well-defined lateral tooth on the lunular (or anterior) side of the shell exists in the left valve, and is received between two laminæ in the opposite valve. On the opposite or posterior side is a faint elongated ridge or lamina. Both tooth and laminæ are distinct from the cardinal margin in this species. There is no internal ligament. The pallial line is slightly but distinctly sinuated. The margin of the shell is not crenate, and bears traces of an exceedingly thin polished and fugacious epidermis. The outside of the valves is concentrically ridged, with fine transverse striæ radiating from the umbo and obsolete toward the margin. The beaks are not compressed; the lunule is smooth.

The mantle has a smooth edge. There are no tubes, but the edges of the mantle are caught together, forming two openings like those in *Gouldia minima* Montague, as figured by H. and A. Adams. Otherwise the two halves of the mantle are wholly disunited, except on the cardinal border.

Prof Adams' type specimen, most kindly lent by the custodian of the Amherst collection * for my examination, is of a pale yellowish brown, and much resembles in form a small *Astarte* of the *borealis* type. It is very similar to *G. minima*, and if occurring in the same region would doubtless be taken to be a variety of it. Florida specimens are often prettily variegated and brightly colored.

Gouldia cubaniana D'Orbigny.

Venus cubaniana D'Orbigny, Sagra, Moll. Cub., II. p. 278, Pl. XXVI. figs. 44–46 (1846). (Cuba, Martinique, and Florida, D'Orb., *loc. cit.*)

Off Sombrero, 54 fms.; Station 36, 84 fms.; Sigsbee, off Havana, in 100, 119, 158, 175, and 450 fms.; Barbados, 100 fms.; Station 5, 229 fms.; Station 44, 539 fms.

This little shell has a similar hinge structure to *Gouldia cerina* C. B. Adams, except that the lateral tooth is much elongated and somewhat obsolete; the sinus in the pallial line is almost invisible; the ligament is quite the same as in Adams' species; the color is pale yellow or light brown, the edge is minutely crenate in perfectly adult specimens, though smooth in the young. It has, as will be observed, a very considerable range in depth.

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* Prof. John D. Tyler.

Crassatella antillarum (?) Reeve.

Reeve, Conch. Icon., I. Mon. *Crassatella*, Pl. III., 1845.

Gulf of Mexico, west of the Florida coast, in 30 fms.

Shell thin, compressed, light brown, with about six strong concentric undulations, a rosy streak extending from the beaks outside and coloring the interior, having much the shape of *C. Robinaldina*, and a length of 11.0 mm., with a height of 6.75 and a width of 2.5 mm. It may take the varietal name of *Floridana* until more nearly adult specimens are accessible, but I strongly suspect it will eventually prove distinct from the above species, to which it is provisionally referred.

Crassatella (Eriphyla) parva C. B. Adams.

Thetis parva C. B. Adams, Proc. Bost. Soc. Nat. Hist., II., Jan. 1845, p. 9.

Gouldia parva C. B. Adams, Cat. *loc cit.*, p. 29, 1847.

Gouldia fastigiata Gould, Proc. Bost. Soc. Nat. Hist., VIII. p. 282, 1862. (North Carolina.)

Astarte Pfeifferi Phil., Zeitschr. für Mal., V. 133, 1848.

Crassatella martinicensis D'Orbigny, Sagra, Moll. Cuba, II. 288, Pl. XXVII. figs. 24–26, 1853 ; "1846."

Crassatella guadaloupensis D'Orbigny, *loc. cit.*, p. 289. Pl. XXVII. figs. 24–26, 1853 ; "1846."

Martinique, Jamaica, St. Domingo, Cuba, St. Thomas (D'Orbigny); Cuba (Pfeiffer); Jamaica (Adams); Station 21, 287 fms. ; Station 44, 539 fms.; Station 33, 1,568 fms. (Blake Exp.).

This seems perfectly distinct from *C.* (*E.*) *mactracca* Linsley, which is identical with *Astarte lunulata* Conrad (Journ. Acad. Nat. Sci., VII. p. 133, 1834), from the postpliocene of Virginia and North Carolina. That the two forms figured by D'Orbigny are mere individual variations, is well shown by the series I have examined. Gould's species seems rather to belong here than with *C. mactracea*. In any case, Conrad's name is long prior to any of the others. A form almost identical with *C. parva* is Prof Adams' *C. pacifica* from Panama, of which *C. varians* Carpenter seems to be only a Northern race.

Cardium serratum Linne.

Cardium serratum Reeve, Conch. Icon. Cardium, Pl. I. fig. 1, 1844.

West of Florida, in 30 fms., Bache ; Barbados, 100 fms.; Sigsbee, off Havana, 127 fms.

This is the *Cardium citrinum* of Wood; the specimens obtained were all rather young.

Cardium medium LINNE.

Several valves of a very young *Cardium*, which may perhaps belong to this species, were obtained by Sigsbee off Havana in 80 fathoms.

Cardium sp. indet.

Sigsbee, off Havana, in 182 fms., dredged several young valves remarkably elegant in their nodulation and reticulation, having about twenty ribs, of which five, with their interspaces, cover nearly half of the shell in its middle part. I cannot identify them with any species figured in the Iconica, but they are too young to be positive about.

Cardium (Fulvia) peramabilis n. s.

Shell having a general resemblance to *Fulvia modesta* Adams and Reeve,* but smaller, less transverse and much more elegant. Shell generally white, but occasionally exquisitely stained with lemon-yellow, orange, and carmine, inflated, nearly equilateral, valves nearly as long as high, beautifully reticulated; outer surface of the valves divided into two areas with different sculpture, the posterior occupying a little more than one third of the surface and separated by a single radiating rib; anterior region sculptured by about forty-five radiating ribs (three in the space of a millimeter) about equal to their interspaces, and reticulated by concentric ridges, strong only in the interspaces, which increase in regular ratio, so that the reticulations form nearly exact squares ; the concentric ridges are occasionally a little irregular or dichotomous, but it does not affect the general very remarkable regularity of the reticulation; in the region immediately in front of the beaks the radiating riblets fail or become obsolete and the concentric ones become crowded, wrinkled, and irregular. Over the posterior region the sculpture differs. The bounding rib, which is really composed of two amalgamated riblets, in perfect specimens should bear a delicate crest bent forward and buttressed behind with spurs extending from the interspaces; this, however, is invariably removed by friction, only small portions of it remaining in occasional specimens; behind this rib the radiating ribs are more slender than in the anterior area, with proportionally wider interspaces barred across with thin lamellæ at regular intervals, which lamellæ are not continuous with the concentric riblets of the anterior area ; from the interspaces project short conical (sometimes grooved and decurved) spurs or spines above the general surface, which are generally mostly removed by friction even in the most perfect specimens ; anterior edge and basal margin rounded ; posterior extreme of the hinge-line slightly angulating the curve of the posterior margin ; within polished ; edges of the shell delicately denticulate ; sculpture varying slightly in fineness in different specimens. Variety *tinctum*, with indistinct rays and concentric waves of darker or lighter carmine and orange, interior suffused with lemon-yellow, sculpture finer than in the common form. The shell does not gape. Lon. 12.5 ; alt. 12.0 ; diam. 9.5 mm.

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* China Seas and Japan, appearing on the northwest coast of America as *Cardium centifilosum* Cpr. and *C. Richardsonii* Whiteaves.

Sigsbee, Station 50, 119 fms. ; U. S. S. Bache, April 22, 1872, 100 fms. ; Barbados, 100 fms. ; Station 9, 111 fms. ; Station 26, 110 fms. ; Station 36, 84 fms. · Lat. 23° 18′. Lon. 89° 10′, 84 fms. ; off Sombrero, 54–72 fms. ; west of Florida. 50 fms.

This very lovely shell is so abundant in the collection, that it seemed almost impossible that it should be undescribed ; but I have not been able to find any description or figure that agrees with it.

Syndosmya longicallis Scacchi.

Tellina longicallis Scacchi, Not., p. 16, Tab. I. fig. 7.

Erycina longicallis Phil., En. Moll. Sic., II. p. 8, Tab. XIII. fig. 7, 1844. (Fossil in Apulia.)

Abra longicallis Sars, *op. cit.*, p. 74, Tab. 6, fig. 3 ; Tab. 20, fig. 4, 1878.

Ligula profundissima Forbes, Rep. Ægean Inv., p. 191, 1843.

Station 41, 860 fms., living.

I cannot distinguish any characters by which this beautifully brilliant little shell can be distinguished from that figured and described by Philippi. I have not seen Scacchi's original paper. Forbes' description is too brief for identification, but it seems likely that his name refers to this species as claimed by Monterosato.

Syndosmya lioica n. s.

Shell allied to *S. tenuis* Müller and *S. similis* Philippi, thin, polished, short, much inflated, white, with a yellowish or translucent epidermis, which sometimes gives it an opaline effect ; sculpture solely of concentric lines of growth, which are accompanied by a different degree of translucency in the shell, so that many specimens show successive waves of more or less opacity and whiteness contrasted with others more translucent, but there is no uniformity in the number or extent of these waves ; beaks inequilateral, nearest the posterior end, which is slightly twisted to the right ; posterior slope short, steep ; posterior end hardly angulated ; anterior slope long, less steep, the angle at the beaks being about 100° ; anterior end rounded ; base produced and rounded, especially before the beaks ; beaks and ligament not prominent ; cartilage narrow, elongated, teeth strong, distinct ; pallial sinus reaching nearly to the anterior muscular scar, rounded in front ; margin smooth. Lon. 8.1 ; alt. 6.75 ; diameter, 4.75 mm.

Twenty miles west of Florida in 30 fms.; off Sombrero in 54 and 72 fms.;

off Sand Key, 30 fms.; Station 36, 84 fms.; Station 9, 111 fms.; Station 5, 229 fms.; Station 2, 805 fms.

It is more produced anteriorly, more inequilateral, and more inflated than *S. tenuis*, and has no radiating striæ; it is shorter, more oblique, more inflated, and has a much larger and deeper pallial sinus than Philippi's "*Erycina*" *similis*, which is a Calabrian fossil. It is very similar in form to Hanley's figure of *Tellina Gouldii* in the Thesaurus. It has, as will be noted, a remarkable range in depth.

Tellina Antoni Philippi.

Tellina Antoni Philippi, Hanley, Thes. Conch., p. 224, Pl. LVIII. fig. 74, 1846.

Obtained by the Bache, west of Florida, in 19 fms.

Tellina plectrum (?) Hanley.

Tellina plectrum Hanley, P. Z. S., 1845; Thes. Conch., p. 265, Pl. LXI. fig. 177.

A single valve, resembling Hanley's figure in most features, but with an outline a little more like that of *Tellina perplexa* Hanley (Manila) was obtained in the Yucatan Strait at a depth of 640 fathoms. To determine positively to what species it belongs would require more material. It may have been washed from shallower water, or disgorged by a fish, and not properly belong in the deeps at all. It is, however, quite fresh, though a little broken.

Tellina Gouldii Hanley.

Tellina Gouldii Hanley, Thes. Conch., p. 272, Pl. LVI. fig. 26, 1846.
Tellina cuneata D'Orbigny, Sagra, Moll. Cub., II. p. 256, Tab. XXVI. fig. 23, 1853.

Yucatan Strait, 640 fms.
Two valves only were obtained.

Tellina sybaritica n. s.

Shell small. solid, shining with a silky lustre, deep rose-pink, darkest at the beaks, somewhat disposed in lighter and darker concentric waves; elongated, donaciform, rather inflated, slightly posteriorly twisted to the right; beaks nearest the posterior end, not prominent; cardinal tooth in left valve strong, bifid; lateral teeth short, strong, rather close to the cardinal; pallial sinus profound, reaching below and nearly as far forward as the anterior muscular scar; sculpture of concentric deep crowded grooves separated by narrow uniform rounded ridges, the fineness and uniformity of which give rise to the silky lustre; a strong not very sharp carina extends backward from the beaks, forming a short square-pointed rostrum, behind which, in the left valve, is a faint flexuosity ; right valve the smaller ; basal and anterior cardinal borders nearly parallel, posterior cardinal border rather steeply sloping to the end of the rostrum ; anterior end rounded, basal margin nearly straight. Lon. from anterior end to beak, 7.0 ; to tip of rostrum, 10.5 ; alt. 5.5 mm.; diam. 3.75 mm. approximately.

Yucatan Strait, 640 fms.

This lovely little species is one of the instances of remarkably fine color in a deep-water shell. It somewhat resembles a miniature *Tellina Tayloriana* Sowerby (Conch. Icon. *Tellina*, Pl. XXX. fig. 168, 1867), but the sculpture is greatly finer, the color purer, and the form not so broad ; *Tellina tenuilirata* Sowerby, from New South Wales (*loc. cit.*, Pl. XXXIX. fig. 219), is still more like it, but is shorter and broader proportionally.

Loripes compressa n. s.

Shell thin, elongated, with squarish bluntly rounded ends, the base and hinge-line nearly parallel, much compressed, dull white, nearly smooth but not polished ; hinge with a single small but distinct cardinal tooth in the right valve, entering a triangular depression in the opposite valve, otherwise edentulous ; beaks inconspicuous nearest the anterior end ; anterior hinge-margin straight, a little sloping ; posterior ditto short, excavated ; ends equally bluntly rounded ; base evenly arcuated ; interior polished, white, margin smooth ; exterior with some malleated irregularities, generally only sculptured by the more or less accentuated lines of growth, which are produced at the hinge-margin into small triangular denticulations and in some specimens rise to extremely thin distant delicate lamellæ on the body of the valves ; surface without radiating striæ, and covered with a pale yellowish epidermis. Lon. 11.0 ; alt. 8.3 ; diam. 2.75 mm.; another broken specimen exceeds 15 mm. in length.

Off Cape San Antonio, in 413 and 424 fms.

This shell is nearest *Loripes anatinelloides* Reeve, which is larger, much more orbicular, more waved before and behind, and has a different sculpture with radiating striæ. It also recalls *Lucina* (*Myrtea*) *spinifera*, but has no lateral teeth, is more quadrangular, much more compressed, and less prominently sculptured.

Loripes icterica Reeve.

Lucina icterica Reeve, Conch. Icon. *Lucina*, Pl. X. figs. 60 a, b, Aug. 1850.

Station 21, 287 fms.; Yucatan Strait, 640 fms.

This shell is quite closely related to *L. lactea* or *leucoma*.

Lucina antillarum Reeve.

Lucina antillarum Reeve, Conch. Icon. *Lucina*, Pl. X. fig. 37, 1850.
Lucina pecten Reeve, *loc. cit.*, Pl. VII. figs. 34, 35 ; not of Lamarck *teste* Reeve.
Lucina occidentalis Reeve, *loc. cit.*, in errata.

Charlotte Harbor, Florida, 13 fms.; Sigsbee, off Havana, in 182 and 450 fms., Yucatan Strait, 640 fms.

Lucina funiculata Reeve.

Lucina funiculata Reeve, *loc. cit.*, Pl. VII. fig. 40, June, 1850.

Station 2, 805 fms.

A single young valve was obtained, probably of this species.

Diplodonta venezuelensis Dunker.

Diplodonta venezuelensis Dunker, Zeitschr. für Mal., 1848, p. 184 ; Nov. Conch., p. 3, Tab. IV. figs. 7, 8, 9, 1858.

Yucatan Strait, 640 fms.

One valve and part of another were obtained.

Diplodonta pilula n. s.

Shell small, round, inflated, polished, with concentric sculpture of slightly raised sharpish ridges ; umbos smooth, polished, prominent, inflated ; margins not angulated, forming nearly a perfect circle, teeth indistinct ; margin smooth ; epidermis if any thin and translucent. Lon. 2.6 ; alt. 2.6 ; diam. 2.6 mm.

Station 43, 339 fms., living.

This little shell resembles a homœopathic pill as much as anything, and, curiously enough, seems to be mature. The teeth are so indistinct that I feel a slight doubt as to whether it is a *Diplodonta* or not.

Cryptodon obesus (?) Verrill.

Fragments of a *Cryptodon* were obtained in 640 fms., Yucatan Strait, which bear some resemblance to *C. obesus* Verrill, though they do not agree with more northern specimens in all respects. These Cryptodons, however, vary considerably, and when fully compared it is probable that the number of nominal species will be reduced.

NOTE.

To the species previously enumerated in this paper, the following (kindly identified for me by Mr. S. R. Roberts, of Philadelphia, who has paid special attention to the group) may be added : —

Trivia globosa Gray.

T. globosa Gray, Descr. Cat., p. 14, 1832.

Station 2, 805 fms.

Most of the specimens of *Trivia* from great depths being dead and having lost their freshness, a reasonable doubt exists as to their having lived at those depths.

Trivia oryza Lamarck.

T. pediculus Rumphius, Roberts Cat. No. 24.

Station 2, 805 fms.

Trivia quadripunctata Gray.

T. quadripunctata Gray, Zoöl. Journ., III. 368, 1827.

Yucatan Strait, 640 fms (fresh) ; Station 2, 805 fms.; Station 12, 177 fms.; Barbados, 100 fms.; Sigsbee, off Havana, 80 fms.

Trivia subrostrata Gray.

T. subrostrata Gray, Zoöl. Journ., III. p. 363, 1827.

Sigsbee, off Havana, in 80 and 175 fms.; Station 12, 177 fms.

Trivia candidula Gaskoin.

T. candidula Gaskoin, P. Z. S., 1835, p. 200.

Yucatan Strait, 640 fms.; Station 21, 287 fms.; Barbados, 100 fms.; Sigsbee, off Havana, 119.

Marginella hæmatita Kiener.

Stations 10 and 11, in 37 fms.

A fourth species of *Pleurotomaria* (*P. Rumphii* Schepman, Tijdschrift Nederl. Dierkundige Vereeniging, IV. p. 162, Rotterdam, 1879) from the Moluccas has been recently described, but I have not had access to the description, and I believe it has not yet been figured. Its height is 170.0, diam. 190.0, and breadth of sinus 2.25 mm. It is an umbilicated species like *P. Adansoniana*.

In closing this preliminary report the attention of the reader is called to the fact that nearly as many forms remain to be enumerated as have here been mentioned; but so far as the Agassiz-Sigsbee collection is concerned, they are mostly from comparatively shallow water. The Agassiz-Bartlett collection still remains to be administered upon, and will certainly afford a number of novelties.

It may be noted that the West Indian marine fauna is in a particularly muddled state. Many species have been described from, but not attributed to the West Indies; many others have been so attributed wrongly. There are few catalogues; of which that of Guadaloupe is most praiseworthy, but all are more or less imperfect and discrepant in nomenclature. There is, perhaps, no other part of the seas commonly traversed by commerce of which so little is actually known and accessible in convenient form for reference. This renders the task of describing species from this fauna both irksome and tedious, since one can never tell what unfigured species, described with a wrong habitat, or without habitat, may not demand investigation, and after all be left in doubt.

I can hardly hope to have entirely escaped the error of redescribing some species under the circumstances. I beg that any one, who may possibly be able to offer some corrections or emendations, will communicate the same to me in order that the final report shall be as complete and perfect as possible.

Since the species could not be taken up in zoölogical or any other definite order an Index has been prepared in which the newly described forms appear in Italic letters; those not new, or mentioned for purposes of illustration, in Roman.

For the benefit of purists I will add that the names applied to new species and groups in this report make no pretence to any more Latinity than that of form, and are intended merely as euphonic combinations of vowels and consonants in the majority of cases.

WASHINGTON, Dec. 5, 1881.

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Leda cœlata, 125.
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Leda dilatata, 125.
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Leda intermedia, 127.
Leda jamaicensis, 124.
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Leda (Lembulus) lamellicostata, 124.
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Limopsis antillensis, 119.
Limopsis aurita, 118, 121.
Limopsis borealis, 119.
Limopsis cristata, 119.
Limopsis minuta, 119, 121.
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Lioconcha, 128.
Liocyma, 123.
Liotia Briareus, 52.
Loripes anatinelloides, 135.
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Mangilia pelagia, 61.
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Margarita asperrima, 40.
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Margarita filogyra, 42.
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Natica pusilla, 93.
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Neæra arctica, 111.
Neæra arcuata, 113.
Neæra claviculata, 112.
Neæra var. *corpulenta*, 111.
Neæra costellata, 110.
Neæra glacialis, 111.
Neæra granulata, 111.
Neæra Jeffreysi, 111.
Neæra lamellifera, 113.
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* This is the same as *N. multicostata* V. & S., and may be distinct from *alternata*.

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Neæra rostrata, 111.
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Puncturella granulosa, 76.
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Ringicula nitida, 97.
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Saxicava azaria, 116.
Scaphander lignarius, 100.
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Sphena ornatissima, 110.
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Syndosmya lioica, 133.
Syndosmya longicallis, 133.
Syndosmya similis, 133.
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Tapes virgineus, 123.
Taranis bella, 71.
Taranis Mörchii, 70.
Tellina Antoni, 134.
Tellina cuneata, 134.

Tellina Gouldii, 134.
Tellina longicallis, 133.
Tellina perplexa, 134.
Tellina plectrum? 134.
Tellina sybaritica, 134.
Tellina Tayloriana, 135.
Tellina tenuilirata, 135.
Terebratula anomioides, 104.
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Thecidium Barretti, 104.
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Thetis, 108, 128.
Thetis cerina, 130.
Thetis granulata, 108.
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Thetis parva, 131.
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Tornatella fasciata, 94.
Trichotropis migrans, 71.
Triforis, 80.
Triforis abruptus, 84.
Triforis bigemma, 81, 82, 83, 84.
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Triforis concors, 86.
Triforis cylindrellus, 83.
Triforis hircus, 83.
Triforis ibex, 86.
Triforis inflatum, 81.
Triforis intermedius, 85.
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Triforis ruber, 86.
Triforis torticulus, 82.
Triforis triserialis, 84.
Triforis turris-thomæ, 81.
Trigoniluna ornata, 105.
Trigonulina ornata, 105.
Trivia candidula, 137.
Trivia globosa, 137.
Trivia oryza, 137.
Trivia quadripunctata, 137.
Trivia subrostrata, 137.
Trochus clavatus, 41.
Trochus tiara, 45.
Trochus transenna, 41.
Turbo indutus, 49.
Turbo (Liotia) Briareus, 52.
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Turcicula, 42.
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Venus minima, 128.
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Yoldia lanceolata, 128.
Yoldia liorhina, 127.
Yoldia nicobarica, 128.
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No. 3. — (Letter No. 5.) — *To* Carlile P. Patterson, *Superintendent United States Coast and Geodetic Survey, from* Alexander Agassiz, *on the Explorations in the Vicinity of the Tortugas, during March and April,* 1881.

I left Key West for the Tortugas in the middle of March on the "Laurel," which Lieut.-Com. Wright had kindly ordered, in accordance with the permission of the Lighthouse Board, to transport myself and assistant, with the necessary coal for the steam launch which you had placed at my disposal during my visit to the Tortugas. The launch I found ready at Key West, fully equipped, manned, and provisioned, thanks to the care of Lieut.-Com. Winn. She arrived at the Tortugas somewhat later in the day than the Laurel.

During our stay at the Tortugas we were allowed by the Hon. Secretary of War to occupy such quarters at Fort Jefferson as were not otherwise needed, and selected as a laboratory a large room, with excellent light, on the ground floor of the barracks. We remained at the Tortugas five weeks, and spent the remaining time at my disposal at Key West, where we continued our studies of the pelagic fauna of the Gulf Stream. We returned to Key West in the revenue steamer Dix, Captain Scammon, whom the Secretary of the Treasury had authorized to assist us as far as practicable.

The prevalence of strong northerly winds during the greater part of our stay in Florida interfered greatly with the work which was the principal object of my visit, — the study of the surface fauna of the Gulf Stream. We expected to find the usual prevailing southeasterly winds, and to find the pelagic fauna of the Gulf Stream driven against the Tortugas. In this respect we were greatly disappointed, and I availed myself of days, otherwise favorable, in finishing a number of drawings of the most characteristic oceanic Tubularians of the Gulf Stream, the Porpitæ and Physaliæ. I had accumulated a number of drawings and notes either at Newport or on the "Blake," but under circumstances not specially favorable for a critical examination of the specimens. A number of interesting stages of Porpita, of Velella, and of Physalia were observed, as well as many points of interest in their anatomy hitherto not noticed.* These will be published in the Memoirs of the Museum as soon as the necessary illustrations can be prepared. The two species of Porpitidæ found in Florida, although they find their way as far North as the southern shores of Massachusetts, are as yet very imperfectly known.

On the days when the weather was not suitable for surface work outside in the Gulf Stream, I employed the launch in cruising inside the reef, and thus examined carefully the topography of the different groups of corals characteristic of the Florida reefs. As the Tortugas are the most westerly of the reefs, and in an active state of growth, the data I have collected are interesting from the light they throw on the share the different species of corals have in the formation of the reef. To illustrate the distribution of the corals, I shall reproduce in one of the forthcoming Bulletins of the Museum one of the charts of the Tortugas published by the Coast Survey, marking upon it the position of the different species of corals within the area occupied by the reef-builders of the Tortugas.

As far as the pelagic fauna is concerned, the prevalence of northerly winds during our visit to Florida prevented us from accomplishing any satisfactory results. The few days on which it was possible to collect the surface fauna of the Gulf Stream showed us, however, a wealth of pelagic animals which I had hardly anticipated. Both the Tortugas and Key West are excellent stations from which to work up the surface fauna of the Gulf Stream. The Tortugas, though more inaccessible than Key West, are practically within the northern edge of the Gulf Stream during the prevalence of southeasterly winds, while at Key West we must go outside of Sand Key to obtain the same conditions. The Tortugas also have the immense advantage of supplying the naturalist, not only with the common species of reef-building corals at his very door, but with the varied invertebrate fauna to be found living in a coral reef. From returns lately made to me by Mr. Cole, the fort keeper at the Tortugas, it is evident that May and June are far more satisfactory months for surface work than March and April. Unfortunately, that is rather late in the season to remain on the Florida Reefs, — an objection which applies equally to all localities which are not sufficiently far within the tropics to be available for pelagic work during the winter months.

The Bermudas, from their position and their marine fauna, naturally suggest themselves as a substitute for the Florida reefs in the study of the surface fauna of the Gulf Stream. From the existence there of certain species of corals, these islands may prove, on trial, the best fitted for a prolonged study, not only of corals, but also of the Atlantic surface fauna.

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* Dr. Chun has, in a preliminary notice in a recent number of the *Zoolog. Anzeiger*, called attention to several of the points here referred to.

In spite of the unfavorable weather, enough was accomplished to show conclusively that by far the greater number of the pelagic animals known from the Atlantic coast of the United States are inhabitants of the surface of the Gulf Stream, and are driven on the northern shores by the prevailing southwesterly winds during the summer and autumn months.

An enumeration of the pelagic species observed during our stay at Key West and at the Tortugas would carry me too far. I will only mention in a general way the presence of a couple of species of Firoloidea, of Phyllirhoe, of several AppendicularIæ, of a small Pyrosoma, of a Doliolium, two species of Salpa, one of which is our common Northern form, and of half a dozen species of Pteropods. Three or four of these, as well as a large proportion of the other pelagic animals, find their way north as far as Newport. In fact, much of our surface work during March and April reminded me of similar work done at Newport from the end of July until late in September, but of course the number of specimens was far greater at the Tortugas. The surface fauna of the Gulf Stream can undoubtedly be best studied at the Tortugas, though important additions to our knowledge of it have been made at Charleston, and at Beaufort, N. C., and along the coast of New Jersey, of Rhode Island, and of Southern Massachusetts.

It is remarkable that Janthina, which is so common at the Tortugas, should not find its way farther north than off Cape Hatteras, in common with other surface things, where I have frequently seen it while on the "Blake," and on other occasions.

There are also found at the Tortugas a large number of pelagic Crustacea in their embryonic stages, among them Phyllosoma and the Nauplius stage of a Peneus similar to that observed by Fritz Müller; also multitudes of young Annelids, Mollusks, Actiniæ, the planulæ of several of the Corals, Echinoderm embryos, and a host of young pelagic Fishes, among which I may mention the young of the Flying-fish and Leptocephali. For the study of the young stages of Fishes and of Acalephs the Florida reefs present an unrivalled field of observation. We were greatly disappointed in the number of the pelagic Foraminifera. We did not meet once a species of Globigerina, which was found quite commonly off the Tortugas in my former cruises in the "Blake," and which Mr. Pourtalès had also observed off Havana. We found a few species of Acanthometra, Thalassicola, and of Sphærozoum.

A thorough study of the surface fauna of the Gulf Stream, with reference to its effect in supplying material for the building of the plateaus upon which the Florida reefs have grown, would require an investigation of at least a couple of months at the Tortugas during the most promising part of the season (May and June), as well as a summer's cruise along the track of the Gulf Stream north of the Bahamas, when the principal work should be the collecting of the surface animals found in the course of the Stream.

A good idea of the richness of the Acalephian Fauna of the Gulf Stream can be formed from the accompanying list of Jelly-fishes observed at the Tortugas and Key West. This list has been prepared by Mr. Fewkes, who during our visit to Florida devoted his time specially to the study of that group.

I may specially mention among the Ctenophoræ a new Ctenophore remarkable as possessing structural characters of the Lobatæ, Saccatæ, and Eurystomæ; also a magnificent species of Eucharis. A pretty, small Discophore allied to Linerges is found in large numbers all along the Florida reefs and has been observed by the "Blake" off the Windward Islands and in the Caribbean Sea. A new species of Glossocodon is the most interesting of the Hydroids. Our harvest was very rich among the Siphonophores: the greater number of the genera characteristic of the Mediterranean were observed for the first time on this coast, either at Key West or at the Tortugas.

CTENOPHORÆ.*

Bolina vitrea Ag.
Idyia ovata Less.
Lesueuria hyboptera A. Agass.
Pleurobrachia rhododactyla Agass.
Ocyroe sp. nov.
Eucharis sp. nov.

DISCOPHORÆ.

Polyclonia frondosa Agass.
Aurelia flavidula Per. et Less.

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* See also, for other geographical lists of Acalephs from Florida and the West Indies, A. Agassiz, N. Am. Acalephæ, and Allman, Hydroidea of the Gulf Stream, Mem. Mus. Comp. Zoöl., and S. F. Clarke, Bull. M. C. Z.

Pelagia cyanella Per. et Less.
Dactylethra formosa Fewkes gen. et sp. MS.

SIPHONOPHORÆ.

Stephanomia atlantica Fewkes MS.
Agalma papillosum Fewkes MS.
Agalma elegans Fewkes.
Agalmopsis fragilis Fewkes MS.
Rhizophysa gracilis Fewkes MS.
Physalia Arethusa Til.
Athorybia formosa Fewkes MS.
Praya sp.
Diphyes Lessonii Huxley.
? Epibulia aurantiaca Vogt.

HYDROIDÆ.

Lafœa sp.
Zygodactyla cyanea Agass.
Modeeria multitentacula Fewkes.
Eucope sp.
Oceania folleata Agass.
Halopsis sp. nov.
Halicalyx gen. nov.
Aglaura sp. nov.
Cunina discoides Fewkes.
Trachynema digitale A. Agass.
Glossocodon sp. nov.
Pennaria gibbosa Agass.
Millepora alcicornis Linn.

VELELLIDÆ.

Velella mutica Bosc.
Porpita Linnæana Less.

Cambridge, Mass., July, 1881.

No. 4. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *in the Gulf of Mexico, and in the Caribbean Sea*, 1877–79, *and along the Atlantic Coast of the United States during the Summer of* 1880, *by the United States Coast Survey Steamer "Blake,"* LIEUTENANT-COMMANDER C. D. SIGSBEE, U. S. N., *and* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

XVI.

Preliminary Report on the Comatulæ,* *by* P. HERBERT CARPENTER.

THE *Comatula* collection of the Museum of Comparative Zoölogy, which has been intrusted to me for examination and description, contains a very large number of specimens from widely different localities. The majority of these were dredged in the Florida Straits and in the Caribbean Sea, under the auspices of the U. S. Coast Survey. There is also a foreign collection, which mainly consists of specimens obtained by the U. S. and N. P. Exploring Expeditions. Many of them are from localities that I had not previously known as the homes of *Comatulæ*, while others are merely additions to *Comatula* faunas already known to me at particular localities. Except in these respects the foreign collection presents no features of special interest.

The case is very different, however, with the collection obtained by the "Blake" in the Caribbean Sea. In one respect, indeed, — the number of duplicates, — it is superior to that made by the "Challenger." A few species occur not only in great numbers, but also at several localities; so that I have been able to study their range of variation in a more satisfactory manner than it has hitherto been possible for me to do in the case of any *Comatulæ* but the common *Antedon rosacea* and *Ant. Eschrichtii.* This opportunity has proved of immense value to me in every way; and I am convinced that continued investigation will reveal the existence of so many intermediate forms, that many types which now appear quite distinct will prove to be specifically identical. This has, in fact, been the case with two of the species described by the late

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* A few species obtained by the U. S. Coast Survey steamers "Corwin," "Bibb," and "Hassler" are also considered in this Report.

Mr. Pourtalès, which I have been compelled to unite under one name, together with three other forms that seemed at first sight quite distinct both from one another and from the two species of Mr. Pourtalès.

The importance of the collection made by the "Blake" in the season 1878–79 may be gathered from the fact that it contains nearly three times the number of species previously known as inhabiting the Caribbean Sea. Under the general name of *Antedon* Mr. Pourtalès had described five species of *Antedon* and four of *Actinometra*, which were obtained by the U. S. Coast Survey steamers "Corwin," "Bibb," and "Hassler," in 1867–72, and by the "Blake" in 1877–78. During a visit to the principal European museums, in the autumn of last year, I examined nine West Indian *Comatulæ*, including six species of *Actinometra* and three of *Antedon*. I believe a few of them to be identical with some of the species of Mr. Pourtalès.

Hence, before I commenced work on the "Blake" collection from the Caribbean Sea, I was acquainted with less than twenty species of *Comatulæ* from that area. Pending the completion of my memoir on the *Comatulæ* of the "Challenger" Expedition, I am unable to give the "Blake" collection the critical attention which is more than ever necessary on account of the number of duplicates which it contains. But so far as I can judge at present, it includes nearly forty new species, besides most of those from the same region which were already known to me. Altogether, therefore, I should estimate that the number of *Comatula* species now known to inhabit the Caribbean Sea is about fifty-five, nearly three quarters of which were first obtained by the "Blake" Expedition of 1878–79.

Comatulæ were dredged at fifty-seven out of the two hundred stations occupied during this season's work. Nearly all of them were in comparatively shallow water, i. e. in depths less than 200 fathoms. On three occasions only did the depth exceed 300 fathoms; viz. Nos. 150, 151, and 222, the depths being 373½, 356, and 422 fathoms respectively; and the *Comatulæ* obtained at these stations represent new and very singular types. The remarkable form *Atelecrinus* (nov. gen., Figs. 1–7) was met with at each station; and at No. 222 the unique specimen of *Antedon columnaris* (n. sp.), which is represented in Fig. 8, was also obtained.

These facts agree very well with the results of the "Challenger" dredgings,* which only yielded *Comatulæ* at twenty stations where the depth exceeded 200 fathoms. One may fairly conclude, therefore, that these animals are essentially inhabitants of shallow water. There is, however, in one respect a considerable difference between the results of the "Blake" and "Challenger" Expeditions.

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* Preliminary Report upon the *Comatulæ* of the "Challenger" Expedition. Proceedings of the Royal Society, No. 194, 1879, pp. 383–386.

The "Challenger" species of *Actinometra* were nearly all obtained at depths of less than 20 fathoms, the genus occurring at only one station where the depth exceeded 100 fathoms. In 1878–79, however, the "Blake" dredged *Actinometra* 3 times at 7 to 50 fathoms, 10 times at 50 to 100 fathoms, 25 times at 100 to 200 fathoms, and 4 times at 200 to 300 fathoms, making in all 42 stations; while *Antedon* was only met with at 34 stations, at all but four of which the depth was less than 200 fathoms.

As might be expected from the above facts, *Actinometra* is not only represented by a larger number of species than *Antedon*, but it is also individually more abundant. *Comatulæ* were especially plentiful at four stations, viz. Nos. 155, 203, 262, and 269; and at all but the last *Actinometræ* were the most numerous, both specifically and individually. In fact at Station 203 no *Antedon* was obtained at all, though at least six species of *Actinometra* were met with.

There are several points of difference between the general *facies* of the "Blake" and of the "Challenger" collections respectively, which supplement one another in a very interesting manner. The great peculiarity of the Caribbean fauna is the abundance of ten-armed *Comatulæ* representing both the principal genera. About two thirds of the *Antedon* species and three fourths of the *Actinometræ* belong to this simple type; while in the remaining species the rays rarely divide more than twice, and in two species only is there a fourth division. In this respect the contrast with the *Comatula* fauna of the Eastern seas is very marked. Ten-armed forms of both genera are there decidedly in the minority, especially of *Actinometra*, in which genus the rays may divide as often as seven times, so that the number of arms falls very little short of two hundred.

The "Blake" collection from the Caribbean Sea may be fairly compared with that made by the "Challenger" in cruising from Cape York through the Banda and Arafura Seas to the Philippine Islands, and thence southwards to the Admiralty Islands. About seventy species were collected from this area, nearly all from depths less than 150 fathoms. The numbers of *Antedon* and *Actinometra* species are about equal, but while half of the former are ten-armed, only three *Actinometræ* are equally simple. These three species all agree in having the second and third radials united by syzygy, and also a syzygy in each of the first two brachials, as in *Act. solaris.*

This area averages about 10° farther south than that of the "Blake" dredgings, and it is possible that the greater vegetative development of its *Comatulæ* may be due to the higher temperature of the shallower water from which they were obtained.

Although three fourths of the *Actinometra* species from the Caribbean Sea are ten-armed, there is not one among them that recalls the *Act. solaris* of the Eastern seas, in which the second and third radials are united by syzygy, and each of the first two brachials is a syzygial or double joint. All the ten-armed *Actinometræ* of the West Indies belong to a type which is but slightly represented in the Eastern hemisphere, viz. that of *Act. meridionalis.* In this type, as in every *Antedon* that I have yet examined, the second and third radials are articulated together by a vertical ridge on each of their apposed faces, at the sides of which are large masses of ligament, but no muscular bundles. The first syzygy in the arms is on the third brachial, while the first and second brachials are articulated together in the same manner as the second and third radials, instead of forming a syzygial or double joint, as in *Act. solaris.* Nearly all the ten-armed *Actinometræ* in the Eastern hemisphere belong to the *solaris* type. The only exceptions known to me are *Act. Cumingii* Müll. sp., from Malacca, and two or three undescribed species from China, Japan, and Sumatra. Even among the "Blake" *Comatulæ*, in which the rays divide more than once, there is very little variety of type. Either there are two distichals united by ligament, or three, of which the axillary has a syzygy, the former case being the more frequent; and in six out of the nine species in which the rays divide a third time, there is only one joint between the distichal and palmar axillaries, to the latter of which it is united by ligament.

On the other hand the Eastern *Comatulæ*, with about the same number of arms (11–40), present several well-marked varieties of type, according to the number of joints in the primary and secondary ray-divisions and their modes of union.

Of all the *Antedon* species dredged by the U. S. Coast Survey, that with the widest range within the Caribbean Sea is the little ten-armed *Ant. Hagenii*, Pourt.* It was obtained by the "Blake" on the Yucatan Bank, and also at various stations between Dominica and Grenada, at different depths between 75 and 291 fathoms; while Mr. Pourtalès dredged it in great abundance at several localities in the Florida

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* Bull. Mus. Comp. Zoöl., Vol. I. Nos. 6, 11; Vol. V. No. 9, p. 214.

Straits. The original type specimens were obtained off Sand Key, and several individuals from Barbados and Grenada differ so much both from them and from one another, that I was at first inclined to regard them as representing two new species; but a more careful examination did not confirm this impression. There are, however, three distinct species besides the type, to which the name *Ant. Hagenii* has been given. The specimens sent to the Museums at Edinburgh and Copenhagen under this specific name do not belong to the genus *Antedon* at all, but are varietal forms of *Actinometra meridionalis* A. Agass. sp.; and among the large number of individuals of *Ant. Hagenii* from the Florida Straits I found a few examples of two entirely new *Antedon* species. One of them is distinguished by having enormous lancet-like processes on the lower joints of its oral pinnules; while the other is a very exceptional type, with no pinnules at all upon the second and third brachials, though those of the other arm-joints are developed as usual. This is a singular condition, which occurs but rarely among the *Comatulæ*. The "Challenger" dredged a specimen near the Philippine Islands which presents the same peculiarity, and another in which the large pinnule on the second brachial is present as usual, but that on the third brachial is undeveloped, though those of the fourth and succeeding arm-joints are perfectly normal. Except in the remarkable type *Atelecrinus* (Figs. 1, 2, 7), which has no pinnules at all upon the ten or twelve lower arm-joints, these are the only *Comatulæ* I have ever met with in an examination of several hundred individuals that present any departure from the ordinary pinnule arrangement.

At Station cccxi. of the "Blake" dredgings in 1880, on the Atlantic coasts of the United States, a small ten-armed *Antedon* was found to be very abundant. It was doubtfully referred by Mr. Agassiz* to *Ant. Sarsii*, which species was obtained by Mr. Verrill, somewhat later in the season, at several localities off the northern coasts of New England.† I have carefully compared the "Blake" specimens with a Norwegian example of *Ant. Sarsii*, which I owe to the kindness of Prof. G. O. Sars, and also with the two specimens obtained by H. M. S. "Porcupine" in 1869, at two stations in the "cold area" of the North Atlantic.

All the specimens agree in their general characters, and must certainly be united under one specific name; but they differ considerably among themselves while corresponding fairly well with Müller's description of

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* Bull. Mus. Comp. Zoöl., Vol. VI. No. 8, p. 150.

† Notice of the Remarkable Marine Fauna occuping the Outer Banks off the Southern Coast of New England. American Journal of Science, Vol. XX. p. 401.

Ant. Sarsii. Both the American and the "Porcupine" specimens are larger and more stoutly built than any Scandinavian ones that I have ever seen. This is especially the case with the American specimens, which have a considerable resemblance to some forms of *Ant. Hagenii.* But the characters of the oral pinnules are entirely different in the two species. Although the number of their component joints may be the same, about 25, their dimensions are very different. In *Ant. Sarsii* the lower joints of the oral pinnules are clear and glassy, and remarkably long, their length being four or five times their width; while in *Ant. Hagenii* the joints are more opaque, and also shorter and thicker, their length rarely exceeding twice their width. Both species agree with *Ant. rosacea* and *Ant. celtica* Barrett, sp., which is identical with *Ant. phalangium* Müll. sp., in the absence of any basal star in connection with the rosette, such as is found in every other species of *Antedon* or *Actinometra* the calyx of which I have been able to dissect.*

I have pointed out above that four distinct types of *Comatulæ* have hitherto passed under the name *Ant. Hagenii.* In like manner the specific designation *meridionalis,* given by Mr. Agassiz † to a ten-armed *Comatula* which has long been known from the coast of South Carolina, has been applied to almost every specimen with ten arms and an eccentric mouth, and even in two cases to forms with more than ten arms, owing to some of the rays forking twice. All of these are true *Actinometræ* with combed oral pinnules,‡ and the name *Antedon meridionalis* must therefore be exchanged for *Actinometra meridionalis* A. Agass. sp.

Among the many individuals sent to me under this specific name, there are at least four distinct types. Mr. Pourtalès § seemed to think that the species varied considerably with age, "older and larger specimens looking so much more massive than the young, that they at first sight appear like different species, although the usual specific characters agree." But almost all the characters given by him in his specific description ‖ apply equally well to every ten-armed *Actinometra* which has no syzygy in the radials or lowest brachials, including those of the Eastern seas, such as Müller's species *Act. Cumingii* and also *Act. echinoptera* (loc. ?), which are nevertheless perfectly distinct from *Act. meridionalis* and from one another. Under these circumstances the specific name *meridionalis* must be restricted to the type from South Carolina, on which it was originally conferred. The only example of this type which has reached me is too imperfect for a satisfactory specific diagnosis to be framed upon it. It is valuable, however, for having two Pentacrinoids entangled in its cirrhi, to which I shall refer immediately. I am inclined to agree with Mr. Pourtalès in thinking that the specimens from French Reef (1869) belong to the same type, and also those obtained by the "Hassler" off Cape Frio. The latter certainly constitute a strongly marked variety (as indicated by him on his labels), which differs from the French Reef specimens in the characters of the cirrhi, and especially in the relative proportions of the lower pinnules. I have dissected the calices of both, and find them to be so very similar that the differences between them can hardly be regarded as due to anything more than local variation. The radials of the French Reef specimens are relatively higher and slightly more sloping than those of the Cape Frio variety; but were these calices fossil specimens I should have much hesitation in referring them to different species. There is another structural character that I shall mention later on as common to certain examples from both localities. It is therefore of some importance as tending to indicate their specific identity.

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* On the Genus *Actinometra* Müll. Trans. Linn. Soc., Sec. Series, Zoölogy, Vol. II. pp. 96–100.

† Seaside Studies in Natural History, p. 121.

‡ *Actinometra,* loc. cit., pp. 20, 28.

§ Bull. Mus. Comp. Zoöl., Vol. V. No. 9, p. 214.

‖ Ibid., Vol. I. No. 11, p. 355.

Lütken has given the MS. name *Antedon brasiliensis* to a ten-armed *Comatula* which is abundant on the coast of Brazil. It was described by Mr. Pourtalès * as answering "to the description of the *Comatula carinata* Lamk. (Leach. sp.)" from Mauritius, and as differing only in some minor details from Zanzibar specimens of *Ant. carinata.* Rathbun has spoken to the same effect,† and though I was at first inclined to follow Lütken in separating the two types, further study has led me to believe in their specific identity. By the kindness of Prof. Möbius, of Kiel, I have been enabled to examine specimens of *Ant. carinata* from Mauritius. This is the original locality of Müller's type specimens, which Prof. E. von Martens courteously permitted me to study in the University Museum at Berlin. I have also seen specimens from Chili, Madagascar, St. Helena, the Seychelles, the Red Sea, and Aden, and find it impossible to separate them specifically. This conclusion is confirmed by the resemblance between the dissected calices of specimens from Bahia and Zanzibar. They are so very similar that, if they were fossils, I should unhesitatingly refer them to the same species. In fact, the Bahia specimens vary considerably *inter se*, and there is less likeness between two calices from this locality than between one of them and a calyx from Zanzibar. *Ant. carinata* is described by Rathbun as probably ranging along the Brazilian coast from Rio Janeiro to Pernambuco. It was not obtained by the "Blake" at all; but it was found in abundance by Captain Cole, of the "Investigator," in 278 fathoms, off St. Lucia, so that it may fairly be considered as belonging to the Caribbean fauna.

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* Bull. Mus. Comp. Zoöl., Vol. V. No. 9, p. 214.

† A List of the Brazilian Echinoderms. Trans. Connect. Acad., Vol. V. p. 156.

The two *Comatulæ* which appear from their abundance to be especially characteristic of the neighborhood of the Caribbean Islands, ranging from Santa Cruz to Grenada, are an *Antedon* and an *Actinometra*, both of which had been obtained previously to the "Blake" Expedition of 1878–79. In the year 1870, M. Duchassaing brought from Guadeloupe to the Paris Museum a fine specimen of *Antedon*, with thirty very spiny arms. Prof. Perrier having kindly permitted me to examine this type and to make a note of its characters, I readily recognized it in the "Blake" collection, and propose to name it *Ant. spinifera*. It was obtained by the "Blake" (1878–79) at ten stations, in depths of from 80½ to 297 fathoms. It was most abundant at No. 269, in 124 fathoms, off St. Vincent, and was also dredged in 278 fathoms, off St. Lucia, by the "Investigator." Its more striking distinctive characters are as follows: —

Antedon spinifera n. sp.

Cirrhi 12–20, long and slender, composed of 40–60 joints, the later ones of which bear dorsal spines. The rays may fork four times, each subdivision consisting of two joints not united by a syzygy. Usually, however, there are not more than two axillaries, the distichal and the palmar, above the radials; and palmars are frequently only developed upon the inner pair of the four secondary arms, so that there are thirty arms in all (as in the Paris specimen), viz. six on each ray, in the following order: 1, 2, 2, 1. Tolerably large sharp spines are scattered irregularly over the calyx and arm-bases. The arm-joints are triangular in outline, alternating with one another from side to side; and from near the base of each triangular surface there rises a strong curved spine, which projects forwards and slightly outwards. On the lower parts of the arms, therefore, there is a double row of these spines alternating right and left of the median dorsal line; but farther out, as the joints become more and more compressed laterally, the two rows gradually coalesce into a single median one, the spines at the same time becoming less and less prominent. The disk bears a fairly complete anambulacral plating, and there is a double row of plates along each edge of the pinnule ambulacra, viz. side plates resting on the pinnule joints and supporting the covering plates which overlap one another alternately from opposite sides. The color varies from almost white through pale straw-color to a light yellowish brown. The diameter of the disk is 6 or 7 millimeters, and the spread of the arms about 20 centimeters.

The common *Actinometra* of the Caribbean Sea is a singularly protean species, which was obtained at twenty-nine stations during the "Blake" Expedition of 1878–79, and once in the previous season. The "Hassler" dredged it off Barbados; and it was found by the "Investigator" at the station already mentioned off St. Lucia, and also on the Martinique and Dominica cable. It ranges from 73 to 278, and possibly to 380 fathoms. Not only is it everywhere very abundant, but it presents a most remarkable series of minor variations on one fairly distinct type, to which I must refer the two forms named *Antedon alata* and *Ant. pulchella* respectively by the late Mr. Pourtalès.* These two forms seemed to me at first sight to represent entirely distinct species; but I have felt obliged to unite them both with one another, and with four others also apparently distinct at first sight. In naming this type I prefer to use the second of the two specific designations employed by Mr. Pourtalès, viz. *pulchella;* for the other, *alata*, refers to a character which, though very marked in some individuals, is barely traceable in others. Generally, the type is a true *Actinometra*, with eccentric mouth and combed oral pinnules; though Mr. Pourtalès gave the name *Antedon* to both his species, the two genera not being so distinctly differentiated at the time he wrote as they are now. Most of the specimens have 20 arms, or perhaps one or two less; some, however, have as few as 12–15, and there is so little difference between them and a few ten-armed individuals occurring at the same localities that I do not think the latter can be regarded as a separate species. A small *Antedon* which is tolerably abundant at five stations exhibits the same variability, and I have met with a few similar cases in the "Challenger" collection. As a rule, however, ten-armed *Comatulæ* are sharply distinguished from those in which the rays divide more than once. *Act. pulchella* is also interesting as furnishing the third instance which I have met with of a variation from the ordinary type of five rays.† One specimen, like one dredged by the "Challenger," has six rays; while another "Challenger" specimen has but four, though in other individuals of each species there is the usual number of five rays. It is curious that this variation, which is common in *Rhizocrinus*, should be so rare among the *Comatulæ*.

The special characters of this species are as follows: —

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[*] Bull. Mus. Comp. Zoöl., Vol. V. No. 9, pp. 215, 216.

[†] Proc. R. S., 1879, p. 385.

Actinometra pulchella Pourtalès sp.

Cirrhi 15–20, of 15–18 joints; the fourth or fifth is the longest, and the following ones gradually develop a blunt spine on the dorsal side. Two radials only visible; the axillary short, wide, and almost triangular. 10–20 arms, most of the rays usually dividing twice, the first division (distichals) consisting of two joints which are not united by syzygy. When the arms spring directly from the radial axillary, the two lowest brachials are united by ligament, as in most *Comatulæ*, and the third is a syzygial or double joint. But in all the arms which spring from a distichal axillary, the two lowest brachials are united by syzygy to form a double joint; and the true third brachial, which is also a syzygial joint, as in all *Comatulæ*, thus becomes the second arm-joint, as in *Act. solaris.** The position of the next syzygy may be anywhere between the 12th and 20th joints, after which there are usually intervals of three or four joints between the successive syzygia. The lower arm joints are sharply wedge-shaped, alternating from side to side, the later ones gradually becoming blunter. In some specimens the dorsal surface of the arms is unusually smooth, the joints not overlapping in the slightest degree; but in others the lower parts of the arms, about as far as the 25th joint, are exceedingly rough. The distal edge of each joint is raised on the side next the pinnule into a high, somewhat recurved plate, with more or less serrated edges. This is largest about the 15th joint and gradually decreases in prominence, the joints after the middle of the arm being quite smooth.† The arms of most individuals, whether rough or smooth, are bordered throughout their whole length by a lateral expansion of the ventral perisome, which embraces the lowest joints of the pinnules.‡ The first pinnules of the arms are rather long, with well-marked terminal combs. The length gradually decreases till about the 10th brachial, and then begins to increase, but there is no specially small pinnule. The terminal comb may continue as far as the 10th brachial, or cease four or five joints sooner. The pinnule joints may be almost smooth, or they may have strong projections towards the dorsal side, even to far out on the arms.

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* This peculiarity is a very marked one. In no case have I found a syzygy in the first joint of any arm springing from a radial axillary. The ten-armed forms thus belong to the type of *Act. meridionalis.* But individuals with 12, 13, 15, etc. arms are by no means rare, and furnish a complete transition to the large examples with 20 arms to which the specific designation (*pulchella*) by Pourtalès is strikingly applicable.

† This character is especially distinct in the *Ant. alata* of Pourtalès from Barbados, and in several specimens, both ten- and twenty-armed, from Station 269 (St. Vincent). In other individuals from this station, as in those named *Ant. pulchella* (Pourtalès), the arms are perfectly smooth throughout their whole length.

‡ This is the character which led Pourtalès to give the specific name *alata* to certain individuals dredged by the "Hassler" at Barbados, in which it is especially marked. It occurs also, though less distinctly, in the original specimens of *Ant. pulchella.* I find it to be a very variable one, even among the different arms of the same individual, some of which are webbed and others not.

The mouth is radial, and the disk either bare or more or less covered with irregular calcareous concretions. Its diameter, in large specimens, is 12 or 15 millimeters, and the spread of the arms is about 25 centimeters. The color (in alcohol) varies greatly, — white, straw-color, and brown, either alone or more or less mixed with a dirty lilac.

The results of my examination of the "Challenger" and "Blake" collections, and of the numerous *Comatulæ* to which I had access in the various European museums last autumn, entirely confirm and extend the conclusions to which I had been previously led respecting the separation of *Antedon* and *Actinometra* as distinct generic types.* A glance at the skeleton is sufficient to enable me to distinguish the genus; and it is even possible to determine the genus of a mere arm fragment, or in fact of a single pinnule. For the problematical red spots (sacculi) at the sides of the ambulacra which have puzzled all the workers on *Antedon* are entirely absent in *Actinometra.* They are much more abundant in some *Antedon* species than in others, but they are always to be found by careful examination. They are also present in *Ophiocrinus, Promachocrinus, Pentacrinus, Rhizocrinus, Bathycrinus,* and *Atelecrinus,* all of which are types with a subcentral mouth. But I have never yet met with them in *Actinometra,* though some specimens of *Act. pulchella* seemed at first sight to be exceptions to this rule. Microscopic examination showed, however, that the appearances are due to irregular aggregations of brown pigment at the sides of the ambulacra, which are altogether different from the vesicular sacculi that are so puzzling in *Antedon* and in the other genera mentioned above.

On the other hand, there are certain structures which are peculiar to *Actinometra,* though far from being as universal in their occurrence as the sacculi are in *Antedon.* I allude to the brown cellular bodies which I have supposed to be sense-organs. I found them first in some specimens of *Act. polymorpha* from the Philippines,† and have since detected them in two of the "Challenger" species, also from the Eastern seas. They are confined almost exclusively to the middle and later pinnules of the ungrooved hinder arms, each one occupying the dorsal half of a pinnule segment just beneath its calcareous axis. There are several individuals in a very large collection of *Act. meridionalis* obtained at French Reef in 1869, which exhibit this peculiarity in a very marked degree. It also occurs in a few individuals of the Cape Frio variety of this species, and is therefore of some importance as tending to indicate the specific identity of the examples from these two localities. In most specimens the spots are confined to the pinnules of the hinder arms, sometimes to one or two arms only; but in one case I found them on all the arms except the two immediately adjoining the mouth. As a general rule, the arms distinguished by their presence are of the ungrooved type, to which I have already called attention.* In some specimens the dimorphism of the arms is exceedingly marked, just as in *Act. polymorpha.* The anterior arms are long, slender, and composed of many joints bearing similar long and slender pinnules; while the hinder arms are shorter, fewer-jointed, and much more fleshy, with stouter pinnules, in which the genital glands are better developed than in the pinnules of the anterior arms. These are grooved and tentaculiferous, while the hinder arms have no ambulacral groove nor tentacles, and the pinnules are usually spotted with the "sense-organs." These may occur in *Act. meridionalis* as early as the 10th pinnule of the arm, while in *Act. polymorpha* I have rarely found them lower than the 25th pinnule.

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* *Actinometra.* Trans. Linn. Soc., Sec. Ser., Zoöl., Vol. II. pp. 17–20, 81, 82. — Quart. Journ. Geol. Soc., Vol. XXXVI. pp. 41–43. — Proc. R. S., 1879, p. 394.

† *Actinometra.* Trans. Linn. Soc., Sec. Ser., Zoöl., Vol. II. p. 40, Pl. II. Fig. 6.

In *Act. meridionalis*, as in all species of which I have been able to examine any considerable number of individuals, the presence of ungrooved arms and of "sense-organs" is altogether inconstant and irregular. But though it is in this way merely a potential character, it is one which is peculiar to *Actinometra*, and is therefore of some systematic value. On the other hand, there is a similar potential character, which so far as I have yet seen is peculiar to *Antedon*, though it appears to be constant in *Pentacrinus.* This is the existence of a complete calcareous plating at the sides of the ambulacra on the arms and pinnules. Many of the *Antedon* species dredged by the "Challenger" in the Pacific resemble *Pentacrinus* in having a very complete anambulacral plating on the disk;† while there is a double row of plates along each side of the ambulacra of the arms and pinnules, especially of the latter. The side plates rest on the pinnule joints and support the covering plates, which can be made to overlap one another from opposite sides so as to close in the groove completely.‡ Several of the "Blake" *Antedons*, including *Ant. spinifera*, exhibit these peculiarities better than some *Pentacrinus* species do. But I have never yet found them in any *Actinometra.* There are many species, such as *Act. pulchella* and *Act. granulifera* Pourt. sp., in which there is a considerable amount of anambulacral plating in the anal area; but it is usually rather of the nature of an aggregation of tubercles than of a regular pavement of plates, and I have never met with it so completely covering the disk and extending out on to the arm bases and lower pinnules as it does in *Antedon*. The species in which I have found it to reach its greatest development is a large one which is common at Cape York, and is probably identical with *Act. robusta* Lütken, MS. The plating supports the sides of the ambulacra on the disk and occupies the intervals between them, the plates immediately adjacent to the grooves being extensively pierced by the water-pores. The plating ceases, however, just within the circumference of the disk, so that the perisome of the arms and pinnules is perfectly bare, just as in the common *Antedon* species which inhabit the North Atlantic. This entire absence of side plates and covering plates on the arms and pinnules of *Actinometra*, even in species which have a strongly plated disk, is a very singular peculiarity, and one which I am quite unable to explain.

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* *Actinometra.* Trans. Linn. Soc., Sec. Ser., Zööl., Vol. II. pp. 31–41, Pl. II. Figs. 3–6. — Popular Science Review, N. S., Vol. IV. pp. 195, 199, Pl. VI. Figs. 1, 2.

† Proc. R. S., 1879, pp. 388, 389.

‡ Popular Science Review, N. S., Vol. IV. pp. 195, 196, Pl. VI. Figs. 10, 12.

The principal differences between *Antedon* and *Actinometra* are conveniently summarized in the subjoined table.

Antedon.	*Actinometra.*
Disk with central or subcentral mouth and five equal ambulacra.	Disk with eccentric mouth and a variable number of unequal ambulacra, at least two of which enclose the anal area in a horseshoe-shaped curve.
Oral pinnules not specially distinguished.	Oral pinnules have terminal combs.
All the arms equal in length, grooved, and tentaculiferous.	Some of the hinder arms may be much shorter than the rest, ungrooved, and non-tentaculiferous.
Red spots (sacculi) always present at sides of the ambulacra.	Sacculi wanting.
"Sense organs" wanting.	Brown spots (sense organs?) may be present on the dorsal side of the pinnule segments, mostly in the ungrooved hinder arms.
Pinnule ambulacra may be protected by side plates and covering plates.	Pinnule ambulacra (when present) unprotected by plates.
Cirrhi many, sometimes very numerous, and more or less covering the under surface of the hemispherical, conical, or columnar centrodorsal.	Cirrhi few in number, and almost entirely limited to the margin of the discoidal centrodorsal.
Outer faces of radials relatively high, with large muscle plates, and much inclined to the vertical axis of the calyx.	Outer faces of radials relatively wide, with small muscle plates, and nearly or quite parallel to the vertical axis of the calyx.

I have mentioned above that two Pentacrinoids were entangled in the cirrhi of the type specimen of *Act. meridionalis* from Charleston. They presumably belong to that species, and are therefore interesting as being the first *Actinometra* Pentacrinoids that I have seen. The smaller one is at about the stage represented at Fig. 1. B on Plate XXXIX. of Dr. Carpenter's memoir on *Ant. rosacea;* * while Fig. 1. C on the same plate, and Fig. V. on Tab. V. of Sars's "Crinoïdes Vivants," † correspond to the condition of the larger specimen, which has seven arm-joints beyond the radial axillaries. The oral plates of the former are plainly visible, but in the latter it is difficult to make out the condition of the disk. The radials, however, are broader and more closely united than in the corresponding stage of *Ant. rosacea*, and their superolateral angles are much less truncated. The basals form a closed ring, and the centrodorsal is scarcely larger than the stem-joints immediately below it. Five of these are short and discoidal, and the next joint much elongated. In both these respects the Charleston Pentacrinoids resemble *Ant. Sarsii* rather than *Ant. rosacea.* As in both these species the lower arm-joints do not bear pinnules at first, but, with the exception of the second brachial, do not acquire them until a much later developmental stage. Both in *Ant. Sarsii* and in *Ant. rosacea* the first pinnule appears on or about the twelfth joint of the growing arm; and it is not until some time later, after several pinnules have been formed towards the end of the arm, that any appear, even on the second brachial. In fact, the basal portions of the arms of *Ant. rosacea* remain without pinnules until after the development of ten cirrhi on the centrodorsal and its separation from the stem. But in *Ant. Sarsii*, which retains its stem until twenty or thirty cirrhi have appeared, all the lower arm-joints acquire pinnules before the close of the Pentacrinoid stage. So far as can be judged at present, this appears to be a somewhat exceptional condition; for I have found five other species besides *Ant. rosacea* in which the third and the following arm-joints do not develop their pinnules until some time after the loss of the stem. Thus a very young *Act. meridionalis* has a relatively large well-combed pinnule on the second brachial, and another fairly large one on the eighth brachial. The intervening joints have small or poorly developed pinnules, that of the fifth brachial being either a mere stump or absent altogether. In a young *Antedon* from Station 231 the 7th to the 9th arm-joints have no pinnules. A young example of another species of the same genus (locality unknown) has a large pinnule on the second brachial, and a small stump on the third. Neither the 4th nor the 5th joint has a pinnule at all, but there are small ones on the 6th and 7th joints, and a larger one on the 8th, which was probably the first pinnule to appear at all.

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* Philosophical Transactions, CLVI., 1866.

† Mémoires pour servir à la Connaissance des Crinoïdes Vivants. Christiania, 1868.

I have sometimes found that the different arms of the same young individual have reached different stages of development. Thus, in a young *Antedon* from station 232, one arm has large pinnules on the 2d and 16th joints, smaller ones on the 3d to the 6th, and mere stumps on the rest of the intervening joints. On other arms, however, there are no pinnules at all between the 4th and the 15th joints. Again, in a young *Ant. phalangium* from the Mediterranean, some arms have no pinnules at all between the 2d and 10th joints; while in one arm there are pinnules on 2, 4, 6, and 10, but none on 3, 5, 7, 8, or 9. This would seem to show that, when the basal pinnules of this species do begin to appear, the first-comers are those borne by the even-numbered joints on the outer side of the arm.

Hence, whatever be the order of succession of these basal pinnules *inter se*, there is good reason to believe that their late appearance as a whole is a marked developmental character among the *Comatulæ*. This is a point of some importance, as will be seen immediately.

During the Gulf Stream Expedition of 1869, Mr. Pourtalès dredged two small ten-armed *Comatulæ* in 450 fathoms, off Cojima, on the coast of Cuba. They were described by him under the name of *Antedon cubensis*;* but the description given by him only applies to the larger and more perfect specimen, which differs considerably from the smaller and much mutilated one. Mr. Pourtalès seems to have recognized that the two were different, for in his description † of the Crinoids obtained by the "Blake" Expedition of 1877–78, he wrote as follows: — "To this species (i. e. *Ant. cubensis*) I refer provisionally two specimens very much mutilated, having lost the cirrhi and the arms, differing somewhat from my type specimen, but possibly the differences may be due to age." He then described a specimen dredged at Station 43, in 339 fathoms (to which I shall refer directly), and added that a smaller, equally mutilated one had been previously dredged by himself in 450 fathoms, near Havana (Fig. 7).

These two specimens are quite different from the type of *Ant. cubensis.* Not only are the first radials visible and the second but little shorter than broad, as was mentioned by Mr. Pourtalès, but the first radials are separated from the centrodorsal by a complete circlet of basals, and there are no pinnules upon any of the first six arm-joints, which are the only ones preserved. An equally mutilated specimen was dredged by the "Challenger" in 350 fathoms, near Pernambuco, and more perfect ones were obtained off Nevis, St. Lucia, and Grenada during the cruise of the "Blake" in 1878–79 (Stations 150, 151, 222, and 260, depths 291–375 fathoms). In most individuals the first pinnule is borne by the 12th arm-joint (Figs. 1, 2), but in one arm of one individual it occurs as early as the 10th joint. In no case, however, is there any pinnule on the second brachial.

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* Bull. Mus. Comp. Zoöl., Vol. I. No. 11, p. 356.

† Ibid., Vol. V. No. 9, pp. 214, 215.

This type is one of singular interest. With the exception of the doubtful genus *Comaster*,* no recent *Comatula* yet known retains its embryonic basals on the exterior of the calyx after the latter part of its existence as a "Pentacrinoid"; while there is no known *Comatula*, either recent or fossil, in which the basal circlet is complete, as it is in some *Pentacrini*,† and in the earlier stages of the Pentacrinoid larva.

As regards the characters of its calyx, therefore, this new *Comatula* may be considered as a permanent larval form. The absence of pinnules from the lower portions of the arms points to the same conclusion; and it is not a little singular to find these two larval characters (viz. a closed basal circlet and pinnule-less arm-bases) persisting in recent *Comatulæ*. The combination seems to me sufficiently remarkable to justify the establishment of a new genus, which I propose to call *Atelecrinus*.‡

The original specimen from Cuba (Fig. 7) is so different from those obtained later (Figs. 1, 3), that it should, I think, be regarded as a distinct species, and may retain the name *cubensis*, originally conferred upon it by Mr. Pourtalès. The other species I propose to name *balanoides*, in allusion to the peculiar form of its centrodorsal (Figs. 1, 3), which was well described as acorn-shaped by Mr. Pourtalès. It may be as much as 5 mm. long by 3½ mm. in diameter, and bears five double rows of cirrhus-sockets, which are separated near its upper end by slight interradial ridges and do not quite reach the dorsal pole. Each socket has a horseshoe-shaped rim which is much more strongly marked in some specimens than in others. The arch of the horseshoe is directed upwards, and the two ends are frequently turned somewhat upwards and outwards, so that the surface of the centrodorsal has a very rough appearance. This is more marked, however, in *Atelecrinus cubensis* (Fig. 7).

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* Journ. Linn. Soc. Zoöl., Vol. XIII. pp. 454–456.

† Ibid., Vol. XV. pp. 210, 213–215.

‡ ἀτελής, incomplete.

In none of the specimens are the cirrhi preserved entire. They are long and slender, consisting of 30+ joints, the lowest of which are quite short; but from the fifth or sixth onwards they are very long ($2\frac{1}{2}$ mm.) and tolerably equal (Fig. 1).

The extent of development of the basals varies with the size of the individual, apparently diminishing with age as in ordinary *Comatulæ*. In the smallest specimen they are wide but low pentagons, which fall away very rapidly from their interradial apices to the points where they meet one another beneath the radials. The middle of each basal rests on the top of one of the interradial ridges at the upper end of the centrodorsal (Figs. 4, 5), just as the basals of *Pentacrinus* rest on the upper ends of the interradial ridges of the stem. The pentagonal shape of the basals is still traceable in the slightly older specimens which are the originals of Figs. 1 and 3; but in still older ones, just as in the Pentacrinoid of *Antedon rosacea*, the amount of the first radials which is visible on the exterior of the calyx, becomes relatively less and less, and the same is the case with the basals. These are best described as triangular, with their lower angles extended so as just to meet those of their fellows and separate the radials from the centrodorsal by what is practically little more than a line, only visible at all under specially favorable conditions of light. In fact, I believe that even this is absent in parts of some of the specimens, the radials coming into partial contact with the centrodorsal just as in *Pent. asteria.*

The acorn-shaped centrodorsal of *Atelecrinus balanoides* is nearly as deep as it is high. The opening of its cavity has a narrow pentagonal rim, from the interradial angles of which strong ridges descend the sloping walls, diminishing in size as they approach the apex, where they die away without meeting one another (Fig. 5). The large openings of the cirrhus sockets are visible between them. Owing to the manner in which they project inwards, the centrodorsal cavity has a five-lobed shape, the re-entering angles between the broad but short lobes corresponding to the interradial ridges. The large upper ends of these ridges are somewhat hollowed, as are the lower surfaces of the basal plates which rest upon them (Fig. 4). When seen edgeways each of these plates has the form of a short triangular prism, with a flattened plate-like extension on each side (Figs. 6 *a*, 6 *b*). They are in complete contact laterally, so as to form an unbroken ring around the central opening of the calyx, which is not quite so large as is shown in Fig. 4; for it is encroached upon by excessively delicate processes that project inwards from near the lateral margin of each basal. Owing to their extreme fragility, — the "rosette" of a small *Antedon* being massive in comparison, — I found it impossible to preserve them intact; but their position is indicated in Fig. 6 *b*.

There is nothing specially remarkable about the radials and the lowest arm-joints of *Atelecrinus*, but the arm-joints generally are somewhat peculiar in their characters. They are rather longer than in most *Comatulæ*, and have shallower bodies, while the muscle plates which rise from about the middle of each joint are unusually thin. There is, in consequence, a series of large gaps between the muscle plates of successive joints, which are occupied by correspondingly large muscular bundles (Figs. 1, 2, 7). These are not concealed from view by superficial perisome as they are in ordinary *Comatulæ;* but the food-groove lies close down upon and between the muscles, all the structures connected with it being very much reduced and contracted together, as I have sometimes found to be the case in *Ant. rosacea.* At the sides of the groove are a few scattered "sacculi" (Fig. 2). The pinnules which are borne by the twelfth and following joints are comparatively short and styliform, and are composed of ten or twelve elongated joints. Their ambulacra are more spotted with "sacculi" than those of the arms, and are fringed with tentacles, of which I have as yet found no traces on the arms.

The following are the chief points of difference between *Atelecrinus cubensis* and *A. balanoides.* In the former species (Fig. 7) the base of the centrodorsal is much wider relatively to its height than in the latter (Figs. 1, 3); the cirrhus sockets are more closely packed, and the points of their horseshoe-shaped rims more prominent; while the five processes at the ventral rim which support the basals are more strongly marked than in any specimen, large or small, of *Atelecrinus balanoides.* In correspondence with this feature, the shape of the basals is very different in the two species. In the little *A. cubensis* they form a kind of belt of tolerably uniform height with its interradial angles somewhat produced, which everywhere separates the first radials from the centrodorsal. The second radials are squarer, and the axillaries project rather more into them than is the case in *A. balanoides;* while the first brachials are relatively shorter, the second longer and projecting more into the first, and the three following joints also relatively longer than in the larger species.

Taking all these facts into consideration, I think it very probable that we are dealing with two distinct species. Although Pourtalès's original specimen (*A. cubensis*) is very considerably smaller than those obtained more recently, its centrodorsal bears quite as many cirrhus sockets as theirs do, or even more. This rather indicates that it is not merely a premature form, as one might be inclined to regard it, owing to the relatively greater length of its arm-joints.

The peculiarities of *Antedon columnaris* are almost sufficiently obvious in Fig. 8. I can find no traces on its columnar centrodorsal of any sutures which would indicate its composition out of two or more anchylosed joints. In fact the alternating arrangement of its cirrhus sockets indicates the improbability of such an anchylosis. They are disposed in five double rows separated by interradial ridges, at the tops of which minute basals are visible, just as in *Pentacrinus asteria*. The lower end of the column is somewhat concave, but appears to be completely closed and devoid of any central perforation. The loose arms obtained with the calyx are rather large and massive, and resemble those of *Atelecrinus* in having the ambulacrum close down upon the top of the large muscular bundles.

In conclusion I may mention that many of the *Comatulæ* I have examined were the hosts of *Myzostomidæ*. The Gulf Stream dredgings of 1867–69 yielded these curious parasites at five stations. They were also obtained on the Yucatan Bank, and at two other localities during the "Blake" expedition of 1877–78, and at fourteen stations between Montserrat and Grenada in 1878–79. Twenty specimens were dredged at No. 269 (off St. Vincent), where *Comatulæ* were very abundant. Captain Cole's haul off St. Lucia also yielded one specimen, and I found another on the *Actinometra* sent to the Copenhagen Museum as *Antedon Hagenii*. The *Actinometra* brought from Yeddo by Prof. E. S. Morse also furnished an example. All the *Myzostomidæ* have been sent, together with those from the "Challenger" dredgings, to my friend, Prof. L. Graff, of Aschaffenburg, who has added so much to our knowledge of the European species.

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EXPLANATION OF THE PLATE.

Figs. 1 – 6. *Atelecrinus balanoides* nov. gen. & sp.

Fig. 1. The best specimen obtained (No. 151, off Nevis). The first pinnule visible is on the 13th brachial, that borne by the 12th brachial being on the opposite side of the arm, and therefore out of sight. × 4.

Fig. 2. Portion of an arm between the 10th and 18th joints, showing the absence of pinnules as far as the 11th joint (inclusive). × 4.

Fig. 3. Side view of the calyx of another specimen. × 8.

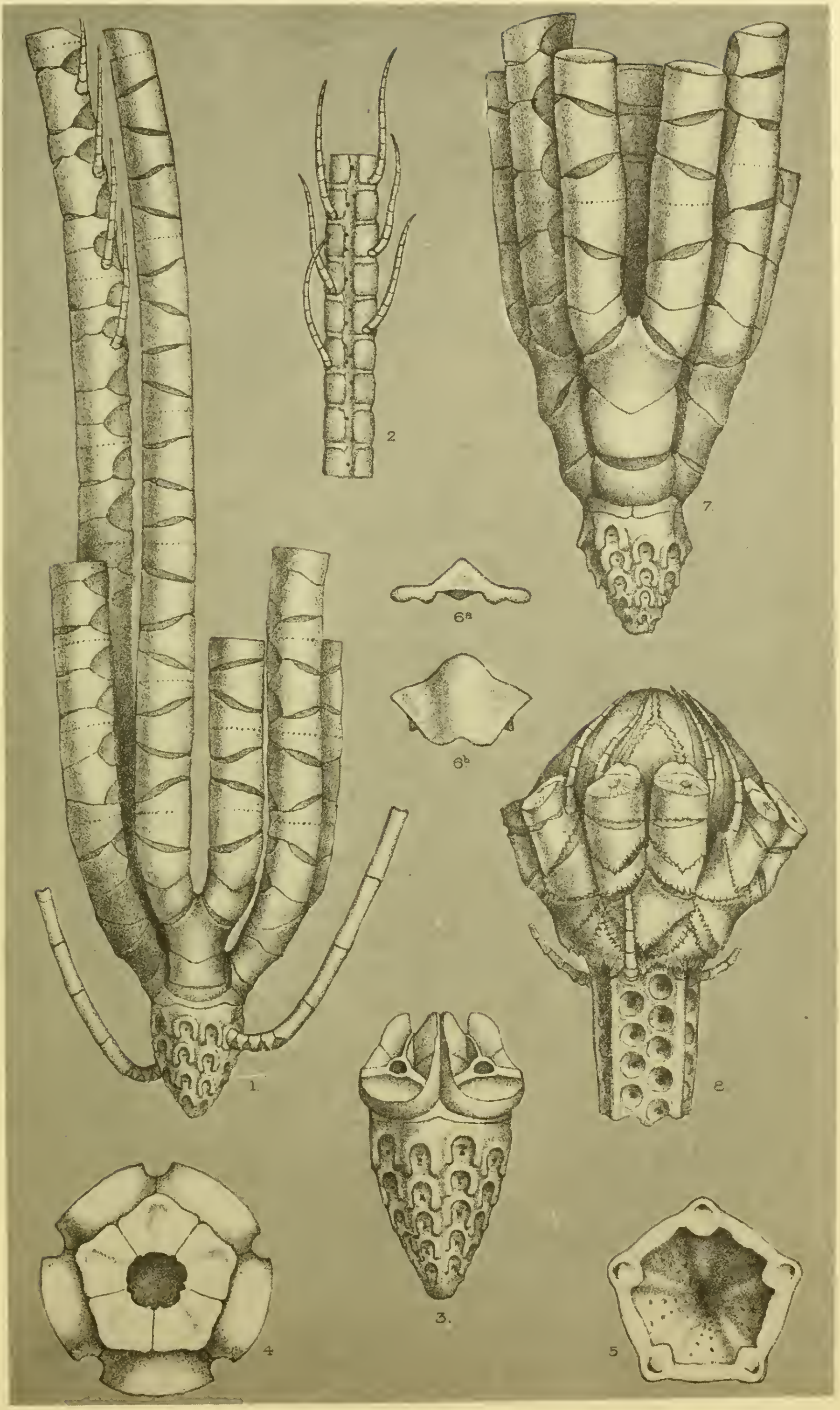
Fig. 4. Radials and basals from beneath. The minute processes at the central ends of the basals are omitted. × 10.

Fig. 5. The centrodorsal from above. × 10.

Fig. 6. A single basal (without its central processes). *a.* From the outer side. *b.* From above. × 14.

Fig. 7. *Atelecrinus cubensis.* Pourt. sp. A single specimen dredged by Mr. Pourtalès, in 1869, off Cojima, near Havana, in 450 fathoms. × 8.

Fig. 8. *Antedon columnaris* n. sp. No. 222, off St. Lucia. × 4.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NEW CARIBBEAN COMATULAE

No. 5. — *Observations on the Species of the Genus* PARTULA Fér., *with a Bibliographical Catalogue of all the Species.* By WILLIAM DELL HARTMAN, M. D.

THE genus *Partula*, proposed by Baron Férussac, in 1819, at the present time embraces numerous species, encumbered by synonyms and manuscript names. This catalogue has been prepared with a view to indicate the former, as well as to eliminate and define the status of the latter, hoping in the future to be enabled to indicate a full and correct synonymical catalogue of the genus, together with a new arrangement of the species. Prior to his decease, the late William Harper Pease was engaged in the preparation of a monograph of the genus Partula, in which he designed describing and figuring all his new species. In anticipation of this work, he freely distributed his manuscript and published species amongst institutions and private collections. Since that time the names of many of the former have been incorporated into printed catalogues, thereby creating confusion in synonymy, and hence it was deemed proper to notice all such in these pages. The large collection of Mr. Pease having, by purchase, passed into the possession of the Museum of Comparative Zoölogy, Cambridge, through the favor of Professor Agassiz of that institution I have been enabled to trace his published and manuscript species with a considerable degree of accuracy. I have also been favored by Andrew Garrett, Esq., of Huaheine, (who collected for Mr. Pease, and was familiar with all his species,) with all the species and varieties of Mr. Pease from the islands the maps of which accompany this paper. In the year 1864, the Rev. P. P. Carpenter published in the proceedings of the Zoölogical Society a catalogue of Partulæ with synonyms, chiefly those of Mr. Pease, which contains numerous incorrect determinations. Mr. Gloyne has also published a partial list of Partulæ in the Quarterly Journal of Conchology, which contains several synonymical inaccuracies. In the proceedings of the Zoölogical Society for 1871, the late William H. Pease published a catalogue of the Polynesian Partulæ, numbering over sixty species. In this list he has omitted twenty-seven species, which embraced all his manuscript, together with a few of his published species. These omissions, it is to be supposed, he regarded at that time as obsolete, or synonyms of known species.

Dr. Pfeiffer, in Vol. VIII. of his *Monographia Heliceorum Viventium*, has enumerated one hundred and four species, but marks thirteen species of Mr. Pease as unknown to him. This is surprising, as the species of Mr. Pease, both manuscript and published, were freely distributed over Germany long before this publication, through the Museum Godeffroy and private channels. The institution named has published a partial list of Partulæ, embracing some of the manuscript species of Mr. Pease. Dr. Pätel in his catalogue has also enumerated about thirty-six species of Partula. Mr. Pease designated about eighty species and varieties of Partula by descriptions, figures, and manuscript names, many of which, however, are synonyms of known species.

The stations of Partula, as published by Mr. Pease and Dr. Pfeiffer, in many instances are incorrect or entirely omitted. These omissions and inaccuracies are often very embarrassing, but in some instances they are attributable to the shells having been collected by missionaries, mariners, and others, who carried them from one island to another until their identity of station was lost or forgotten; and in this manner species belonging to Tahiti or the Marquesas have been erroneously accredited to the Sandwich or other islands. In the present catalogue, Mr. Garrett vouches for the correctness of all the stations to which his name is attached.

So far as known, the genus is confined to the Pacific Islands. They have never been found at the Sandwich group, or New Caledonia; its western limit is New Guinea, and they are not found in New Zealand or Australia. North of the equator, they are found at the Pelew Islands, and as far north as Guam in the Ladrone Islands. The New Hebrides and Solomon's Island have afforded a few species almost unknown to collections in this country. The metropolis of the genus is situated in the Polynesian Islands, but few species being found in the islands of other groups. Of these the island of Raiatea, having a length of fourteen miles and a breadth of three to four miles, is principal: about thirty species and varieties are accredited to this island alone. "The different species are confined to small areas, or restricted to single valleys, each of which has its specific centre, and the range of many species is quite circumscribed. When a species has migrated to an adjoining valley, it has retained all the specific characters belonging to its ancestors at the centre of distribution. Certain species and varieties are confined to separate valleys. P. Hebe Pse. will be found in one valley, while P. globosa Pse. Mss. = Hebe var. will be found in a remote valley. P. hyalina Brod. and P. faba Mart. range through all parts of the islands where they occur. The island of Bora-bora, eighteen or twenty miles northwest from Raiatea, should, from its size as compared with other islands, produce five or six species. On the contrary, it produces but a solitary species, P. lutea Less., which is remarkably uniform in its specific character, and widely distributed over the island. P. hyalina Brod. has the widest range of any other species inhabiting the Polynesian Islands; it has spread over Tahiti, and is abundant at the Austral group, over three hundred miles south of the former island. It is also found at Mangaia, one of Cook's Islands, five hundred miles southwest of Tahiti. The Polynesian group, in which the greatest number of species occurs, comprises eight islands, six of which are inhabited by more than half of the known species of the genus. The distance of these islands from each other is from ten to ninety miles. The former distance is between Tahiti and Moorea, and the latter separates Moorea from Huaheine. Tahaa and Huaheine are only three or four miles apart, but are enclosed in the same encircling reef, and may be regarded as one island separated into two by more or less shallow water. Tahaa is inhabited by two or three species comprising two or three distinct types, which are also represented on Raiatea, but not elsewhere. Bora-bora is ten miles from Tahaa, and, as before mentioned, possesses but a single species. Notwithstanding the short distance between the several islands, and the constant intercourse of the inhabitants for hundreds of years, not a single instance has come to my knowledge of a species having been introduced from one island to another." *

Hybrids are common amongst some species, and rare with others. They even occur between arboreal and ground species. As to the amount of fertility existing amongst hybrids, we possess no certain data, but to these intermediate forms is to be ascribed the embarrassment which so often besets the conchologist in the determination of species. As was to be expected, the hybrids in my collection are chiefly *the result of the union of proximate species.* I possess three which partake of the mingled characters of P. crassilabris Pse. and P. bella Pse. Mss. = Hebe var.; one between P. affinis Pse. and P. rubescens Rve. = Otaheitana var.; two between P. radiata Pse. Mss. and P. faba Mart.; several between P. virginea Pse. Mss. and P. amanda Garr. Mss. = faba var.; three between P. virginea Pse. and P. dubia Garr. Mss.; two between P. virginea Pse. Mss. and P. dentifera Pse., several between P. Garrettii Pse. and P. Thalia Garr. Mss.; two between P. faba Mart. and some unknown species; besides a few others which I cannot locate.

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* Garrett in litt.

Like many other Terrestrial Mollusks, Partulæ are known as Viviparous Hermaphrodites, and on this account they may differ from bisexual animals, in producing hybrids more or less fertile; and we may hazard the conjecture that some varieties of Partula originally may have resulted from fertile hybrids, being the first step in the formation of a race, afterwards intensified and rendered permanent by confinement to the food and climatic influences of one station, and to having been bred in and in, in such positions, for a long period. With respect to the mutation of species of Mollusca caused by food and station alone, we have a striking instance in the Achatinellas of the Sandwich Islands, a genus in many respects analogous to Partula. It often happens that "the gravid females are washed by heavy rains from a favored position to drier levels, where after a few generations the progeny become depauperated, and so stunted in size as to be mistaken for distinct species." The distribution of the different species of Partula throughout the Pacific islands in some instances is not correctly ascertained; and before we can pronounce with certainty on the stations occupied by some species, we must await a more thorough exploration of these islands, the conchology of which has not been accurately observed.

Andrew Garrett, Esq., of Huaheine, who has resided and collected for many years in the Polynesian Islands, contends "that, as the different varieties of Partula are found in limited areas, all those exhibiting slight but constant differences should in most cases be acknowledged as distinct species." To this end he has kindly prepared the accompanying maps to illustrate their distribution. The names underlined on the maps indicate their metropolis or specific centre. A double line marks the locality of a ground species. *Partulæ*, like *Trochomorpha*, *Nanina*, *Helicina*, *Succinea*, and some other Terrestrial Mollusks in tropical countries, are divided into Arboreal and Terrestrial species. The former being found during the dry season gummed to the leaves and bark of trees, while the latter are found at all times under decayed wood and leaves. "The character of the animals affords but little aid in the determination of species. In those of P. arguta Pse., P. turgida Pse., P. annectens Pse., and P. gracilis Pse., the exudation of mucus is much more viscid and tenacious than in other species. The ocular tentacles in these are longer and more slender, and the colors of the soft parts as seen through the pellucid shells are more variegated, than in the solid species. . . . . The animals of the arboreal species are lighter-colored than the terrestrial. The color of the animals in all the solid species varies from a pale cinereous, through all the intermediate shades of black, to dusky slate, while the thin-shelled species before mentioned are more or less of a luteous color." * The shells of many species of Partula vary in size, weight, and coloration. When numbers of these apparent varieties are compared, aided by a microscopic examination of the surface of the shell, their specific identity is obvious. Some Partulæ may readily be mistaken for small Bulimi, especially that division of the genus in which the pillar tooth is absent, and the lip not broadly reflected, and concave, as in P. rosea Brod. In other species the lip is widely reflected, thick, and flat, often with a large pillar tooth within, which gives the aperture an auricular appearance, as seen in P. auriculata Brod., constituting two natural divisions of the genus, the *Auriform* and *Buliminoid*, which are divisible into sub-groups.

Partulæ differ from Bulimi in having the columella broadly reflected and compressed at base, leaving an umbilicus of variable size, whilst a few are imperforate, or narrowly umbilicate, and many species constantly exhibit a small tubercle on the columella. The spiral striæ of the surface together with the embryonic fovea of the apex of the shell are found in all the species. Some species are constant in form and color, and also in the presence or absence in the adult of a denticle on the columella and a pillar tooth, whilst other species are more variable, especially as regards the latter feature. In P. spadicea Rve., only one specimen in fifty has a pillar tooth, while in others the tooth is not absent in several hundred specimens. The same variation is observable in sinistral Partulæ. P. Mooreana nobis is both sinistral and dentate in fifteen hundred examples. P. Otaheitana Brug. and varieties exhibit a majority of reversed examples, while P. vexillum Pse. has one in fifty and P. affinis Pse. only shows one in several hundred.†

In sinistral examples, the whorls are either excessively drawn out, as in P. bulimoides Less., P. rubescens Rve., and P. perversa Pse. Mss. = Otaheitana Brug.; or they are closely rolled together, as in P. crassa Pse. Mss. and P. brevicula Pse. Mss. = P. Otaheitana vars.

In the auriform division of the genus the lip of the immature shell is at first concave, the outer margin in the early stages partaking of the color of the epidermis. This concavity and coloration disappears as the nacreous deposit increases with age, the thick flat labium and elevated pillar tooth always indicating maturity.

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* Garrett in litt.

† I possess a sinistral example of Patula Cooperi W. G. Binn., from Colorado, selected from bushels of dextral specimens.

The mature reflected lip of Partula always exhibits numerous interrupted microscopic lines, running in the direction of the peritreme. In all thin-shelled species the surface is more thickly crowded by the waved spiral striæ, common to all the species, than in the heavy and thick-shelled varieties: in the latter, they are not so conspicuous, partly owing to the decussation of the more coarse oblique lines of growth.

The shells of the same species of Partula often vary in color. Albinism is often present; but the species vary through all the shades of dark bay to pale or reddish chestnut, greenish yellow, rufous, hyaline, and white.

The colors, which are deposited by glands on the margin of the mantle, are not found in the embryo, but after extrusion and exposure to light and heat the colors appear; and owing to the latter influences, the arboreal species are more beautifully marked than the terrestrial. The colors of the shell are arranged in streaks, rays, or bands, the latter varying in number and width, while the former follow the direction of the whorls, becoming wider as the shell increases. Like Achatinella, some species possess a white sutural line beneath the whorls of the spire, and the uniform dark purple or rose tint of the apical whorl is a marked feature in the coloration of many species. In the embryonic shell the fine spiral striæ of the epidermis at the apex (when viewed by a glass) are seen to consist of spiral rows of foveæ, or separate depressions in the epidermis, which occupy the first one and a half or two whorls (the usual number they possess when extruded from the oviduct). After birth the foveæ are discontinued; but we see in their stead the fine spiral waved striæ common to all the species, the embryonic foveæ always remaining at the apex of the shell, constituting a generic feature common to all Partulæ with which I am acquainted. In Partula, as in some species of Helix, Bulimus, Achatinella, and many viviparous fresh-water genera, as Paludina and Lanistes, we meet with what are termed sinistral or reversed individuals. We can only conjecture as to the cause of this departure from the more usual conformation; but it may be owing to a reversal of the vital forces acting during the segmentation of the yolk of the egg in the early stages of the formation of the embryo. The eggs of the common garden slug (which are almost transparent, and afford good material for observation) a short time after deposition exhibit the germinal vesicle (which lies in the midst of the yolk) rising to the upper part, where a distinct rotation may be seen; after which it undergoes segmentation, and the germ appears. The rotary motion, which is probably due to ciliary or vital action, consists of two or three turns in one direction and the same number in a reversed one; and in this reversed vital action during segmentation of the yolk of the egg may lie the secret of sinistral or reversed shells. Several years ago I received from Mr. Garrett a number of species of Partula in alcohol. These I presented to William G. Binney, Esq., of Burlington, New Jersey, well known to scientists for his work on the anatomy and lingual dentition of Terrestrial Mollusks; and his observations on Partula are reported in the Proceedings of the Academy of Natural Sciences, Philadelphia, for April, 1873, which may be epitomized in this place as follows: "In the examination of the animals of twenty-three species of Partula he not only found the external characters to agree generically, but the peculiarity of the lingual dentition was constantly exhibited. Nothing remarkable was observed in the nervous, respiratory, or alimentary systems." "The jaw differs in the different species in the more or less attenuation of the ends, and also in the number of plates of which it is composed. The lingual membrane is broad, and the denticles vary in size and number in the different species, as in other Terrestrial Geophila. Excepting that some of the membranes had narrower teeth than others, he found no difference in them. The Genitalia differed somewhat in the different species, illustrations of which accompany the paper. Férussac's observations concerning their viviparous character were confirmed, but he had overlooked the fact that the animal possessed the two inferior tentacles."

Through the kindness of Professor Dall I have received some Partulæ in alcohol from the Smithsonian Institution, some of which I have submitted to a microscopical examination of the jaw and lingual dentition. I find the number of plates in the jaw on each side of the median line varies in the same species, as well as in the different species, agreeing in this respect with other terrestrial Geophila. For example, in P. subangulata Pse. Mss. = P. faba Mart. var., the formula was $\frac{32}{46}$, $\frac{53}{46}$, $\frac{40}{46}$, $\frac{40}{43}$, $\frac{40}{42}$, $\frac{40}{42}$. In P. obesa Pse. Mss. = P. auriculata Brod. var., the formula was $\frac{35}{36}$, $\frac{32}{42}$, $\frac{36}{36}$, $\frac{26}{32}$, $\frac{36}{38}$, $\frac{36}{35}$, $\frac{36}{44}$. Of P. vexillum Pse., P. Ganymedes Pse., and P. inflata Rve., I possess but one specimen each. In P. vexillum the formula was $\frac{30}{30}$; in P. Ganymedes, $\frac{29}{36}$; and in P. inflata, $\frac{25}{31}$. The form of the teeth and dental formula in P. Ganymedes and P. inflata are similar, the only difference being in the number of rows on each membrane. The shape of all the jaws agreed with the figure of Mr. Binney. Whether the number of plates in the jaw or the number of denticles on the lingual membrane depends on the age of the individual, I am not prepared to affirm. The shells, however, from which my examples were taken were all mature, which is always indicated by the thick, flat, and fully expanded lip. In the examination of the lingual membranes, not only of Partula, but of all other Gasteropods, it is noticeable that the denticles of the anterior extremity of the lingual membrane are always more stout and prominent, gradually diminishing in size towards the posterior part, where for several rows the denticles become almost obsolete, presenting at last a mere rudimentary appearance. In preparing a lingual membrane for a slide it may be observed that the denticles at the anterior extremity always separate more readily from the membrane. This, taken in connection with their gradual diminution in size, has suggested the query in my mind whether the wear and loss of the anterior denticles were supplied by a constant renewal of those from behind. From the continued presence of rudimentary denticles in varying stages of growth on the posterior part of the lingual membrane of all *Gasteropodous Mollusks*, whether terrestrial, fluviatile, or marine, which I have examined, it would seem probable that the mode of growth is such as I have indicated.

To Andrew Garrett, Esq., of Huaheine, who for many years has collected in the various islands of the Pacific, I am under many obligations for specimens and information in reference to the stations and distribution of Partulæ, together with other facts of his personal observation embodied in this paper. To the Conchological Department of the Museum of Comparative Zoölogy, so ably represented by Prof. Charles E. Hamlin, I am indebted for the opportunity of examining the collection of Partulæ belonging to the late William Harper Pease, and also for his kindness in selecting a suite from the duplicates in the Museum. To the personal friendship of Professor Baird, seconded by his efficient assistant, Professor Dall, I owe many thanks for the opportunity afforded me of examining the collection of Partulæ contained in the Smithsonian Institution. To Edgar A. Smith, F. Z. S., Assistant Conchologist in the British Museum, I am under obligations for his kindness in comparing my specimens with types in the Museum, and for valuable information pertaining to the same.

For specimens I am indebted to many friends, among whom I may mention A. D. Brown, Esq., of Princeton, New Jersey; Robert Damon, Esq., of Weymouth, England; Mr. Robert F. Geale, formerly with Hugh Cuming; G. B. Sowerby, Jr., Esq., of London; and Dr. Schmeltz, of the Museum Godeffroy, Hamburg.

To Mr. Geo. W. Tryon, Jr., Curator of the Conchological Department of the Academy of Natural Sciences, Philadelphia, I am especially obliged for his uniform courtesy in aiding me in the examination of books and specimens belonging to the Academy.

GENUS PARTULA FERUSSAC. 1819.

Helix Müll. — *Otis* Humph. — *Auris* Chem. — *Bulimus* Brug. — *Volute* Dill. — *Partulus* Beck. — *Partula* Pfr., W. H. Pease, O. Semper, W. G. Binney.

[All species marked with a dagger are embraced in my collection — Species are printed in Small Capitals; synonyms, in *Italics*.]

P. ABBREVIATA Mouss., J. C., xvii. p. 339, pl. 15, f. 7, 1869. Island Tutuila, Gräffe.

† P. *abbreviata* Pse. Mss. (non Mouss.), Mus. Godeff. Cat., v. p. 91, 1874. Island Raiatea, Garr. = P. Thalia.

† P. ACTOR Albers, (Partulus) Helicien, p. 87, 1850. Belcher Island.

P. *adusta* Garr. Mss. in litt. Tahiti, Garr.

† P. *affinis* Pse., A. J. C., iii. p. 224, 1867, Tahiti, Garr. = lignaria. This shell is variable in size and color; it is often confounded with small dextral examples of P. Otaheitana; some are more elongate than others, while a few are almost globose. In the Pease collection, a few of the latter were labelled by him P. bacca, Pse. Mss. The pillar tooth is often absent, and the shell is usually smaller in size than depauperated examples of P. Otaheitana, of a dark bay or rufous color, often with darker oblique striæ, and occasionally with a dark-brown band at the periphery. The surface is always smooth, looking as though it had been oiled. All specimens of P. rufa from correspondents = P. affinis; the former is said to occur in the Caroline Islands.

† P. ALABASTRINA Pfr. (Bulimus), P. Z. S., p. 39, 1856. Fiji Islands, Geale. Solomon's Island, Cox.

† P. *alternata* Pse. Mss., Moorea, Garr. = P. suturalis Pfr.

† P. *amabilis* Pfr. (Bulimus), P. Z. S., p. 38, 1850. Tutuila and Anaa Islands, Tahiti, Garr. = P. Otaheitana var.

P. *amanda* Garr. Mss., Tahaa, Garr. = P. faba var.

† P. ANNECTENS Pse. (Bul.), P. Z. S., p. 671, 1864. Huaheine, Garr.

† P. *approximata* Pse., Mus. Godeff. Cat., v. p. 207, 1874. Raiatea, Garr.

† P. ARGUTA Pse. (Bul.), P. Z. S., p. 670, 1864. Huaheine, Garr.

† P. ASSIMILIS Pse., A. J. C., p. 230, pl. 15, f. 28, 29, 1867. Raratonga, Garr. This shell may prove to be a local variety of P. varia.

† P. ATTENUATA Pse , P. Z. S., p. 672, 1864. Raiatea, Tahiti, Garr.

P. *Australis* Brug. (Bul.), Encyc. Meth., i. No. 83, 1792. = P. faba.

† P. AURICULATA Brod., P. Z. S., p. 33, 1832; also Conch. Icon. Mon. Part., pl. 2, f. 11^a, 11^b, 1849. Tahiti, Garr.

P. *bella* Pse. Mss., Pätel Cat., p. 104, 1873. Raiatea, Garr = P. Hebe var. This shell has been widely distributed as P. bella Pse. Mss. The true P. bella Pse. is claimed for the next species.

† P. *bella* Pse. Mss. In Coll. A. N. S. Phila. ex auctore = P. *Amanda* Garr. Mss. = P. faba var., Raiatea. This shell was deposited in the A. N. S. by Mr. Pease, long anterior to the date of Pätel's Catalogue.

† P. *biangulata* Pse. Mss., Coll. Pse. = P. faba var.

† P. *bicolor* Garr. Mss. in litt. Huaheine, Garr. = P. varia var.

† P. BICOLOR Pse., P. Z. S., p. 473, 1871; also A. J. C., vii. p. 26, pl. 9, f. 4, 1872. Guam.

† P. BILINEATA Pse., A. J. C., ii. p. 201; id., iii. p. 81, pl. 1, f. 10, 1866–1867. Tahaa, Garr.

† P. *Brazieri* Pse., A. J. C., vii. p. 27, pl. 9, f. 5, 1872. Island Tutuila, Brazier; specimens in A. N. S. Phila. ex auctore = P. Turneri.

† P. *brumalis* Rve., Conch. Icon. Mon. Part., species 2, pl. 1, f. 2, 1849. Ponape; = P. Guamensis.

† P. *brevicula* Pse. Mss., Coll. Pse. = a short sinistral P. Otaheitana, Tahiti.

† P. *brunnea* Pse. Mss., Coll. Pse. = a dark elongated variety of P. faba.

† P. BULIMOIDES Less., Voy. Coq., p. 326, 1829. I have no hesitation in pronouncing upolensis, canalis, semi-lineata, and conica varieties of this species.

† P. CALEDONICA Pfr. (Bul.), P. Z. S., p. 387, 1861. New Hebrides. = Pfeifferi = P. Macgillivrayi. So far as I have been able to secure specimens of these species, it would seem that the two former are slender or depauperated varieties of the latter.

† P. *calistoma* Smeltz, Mus. Godeff. Cat., v. p. 507, 1874 = callifera.

† P. CALYPSO O. Semper, J. C., xiii. p. 417, pl. 12, f. 5, 1863. Pelelilu. This shell, together with P. Thetis and P. Leucothoe, are all from one island; the figures are all of one type, differing only in size and coloration.

† P. *canalis* Mouss., J. C., xiii. p. 132, 1869. Tulare, Upolu, Garr. = Bulimoides, yellow sinistral variety.

† P. CALLIFERA Pfr., P. Z. S., p. 333, 1856. Raiatea, Garr.

P. *Cepolensis* Mouss. Mss., Pätel, Cat., p. 83 = Upolensis.

† P. CARTERENSIS Quoy et Gaim, (Helix), Voy. Astro., ii. p. 117, pl. 9, f. 10, 11, 1830. Specimens of P. spadicea are sometimes confounded with this species. P. Carterensis is more solid and slender, the spiral striæ are almost obsolete, and more widely separated than P. spadicea and varieties. In the former, the denticle on the columella is absent, while in the latter it is always present.

† P. *castanea* Garr. Mss. in litt. Faaloa valley, N. E. coast of Raiatea, Garr. = P. terrestris.

† P. *citrina* Pse., A. J. C., ii. p. 195, 1866. Raiatea, Garr. = P. faba var.

† P. CINEREA Albers, Moll. Blat., p. 98, 1857. Solomon's Island, Dr. Cox. The spiral striæ in this shell are more regular, less waved and crowded than in P. spadicea and varieties, some examples of which it resembles.

† P. CLARA Pse., P. Z. S., p. 671, 1864. Tahiti, Garr. In the Smithsonian collection this species is regarded as = P. hyalina ; it is doubtless a good species. Mr. Garrett informs me that it seems to be rapidly disappearing from the island of Tahiti.

† P. *cognata* Pse. Mss., Mus. Godeff. Cat., v. p. 92, 1874. Huaheine, Garr. = P. rosea var.

† P. COMPACTA Pse., A. J. C., ii. p. 200; Id. iii. p. 81, pl. 1, f. 9, 1866–67. Raiatea, Garr. This shell possesses the keyhole aperture of P. auriculata; it is a good species.

† P. COMPRESSA Pfr. Mss. (Bul.), Mus. Cuming, Conch. Icon. Mon. Part., species 20, pl. 4, f. 20, 1850, Fiji Islands, coll. Taylor. This shell is very rare in collections.

† P. CONCINNA Pse., A. J. C., vii. p. 196, 1872. Tanna, New Hebrides. Mr. Pease remarks, "This shell is the type of P. repanda"; it resembles it in contour, but is less than half the size of P. repanda.

† P. *conica* Gould, Proceedings Boston Soc. Nat. Hist., p. 196, 1848. Rarkaa and Samoa Islands, Gould. Upolu, Garr. Tulare, Navigator's Islands, Cox = P. bulimoides.

P. *Cookiana* Mouss. Mss., p. 28, f. 28, 29. Raratonga (Garr. in litt.) = P. assimlis ?

† P. *Coxi* Angas, Cox, Cat. Land Shells of Solomon's Island, p. 46, 1868. Ysabel and Solomon's Island, Dr. Cox. I have been unable to find any notice of this shell except in the catalogue of Dr. Cox. Specimens labelled P. Coxi from several correspondents = P. grisea; those from Dr. Cox = P. micans.

† P. CRASSILABRIS Pse., A. J. C., ii. p. 199; Id. iii. p. 81, pl. 1, f. 6, 1866, 1867. Raiatea, Garr.

† P. *crassa* Pse. Mss., Mus. Godeff. Cat., v. p. 92, 1874 = a sinistral short heavy specimen of P. Otaheitana. Tahiti.

P. *crassiuscula* Garr. Mss. in litt. in Mus. Godeff. Pacific Isls., Garr.

† P. *decorticata* Pse. Mss., Coll. Pse. Raiatea = P. dentifera denuded of epidermis.

† P. DECUSSATULA Pfr., P. Z. S., p. 131, 1850. Con. Icon. Mon. Part., species 24, pl. 4, f. 23, 1849. Dominique, Marquesas, Garr. Samoa, Pse. Navigator's Isls., Dr. Cox.

† P. DENTIFERA Pfr., P. Z. S., p. 85, 1852. Raiatea, Garr. Solomon's Island, Dr. Cox.

P. *diminuta* C. B. Adams, Ann. Lyc. Nat. Hist., v. p. 81, 1850. Society Islands. I have been unable to identify this shell. It would seem that the types in the Adams collection are lost. From the description I am inclined to believe it a variety of that protean species P. Otaheitana.

† P. DUBIA Garr. Mss. in litt. Tahaa, Garr. = faba dentate var.*

† P. *elongata* Pse., A. J. C., ii. p. 196; Id. iii. p. 81, pl. 1, f. 2, 1866–67. Moorea, Garr. = P. spadicea var.

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* Andrew Garrett, of Huaheine, will describe the Mss. species of Mr. Pease and himself which are marked as good species in this catalogue.

P. *Erhelii* Morelet, J. C., iv. p. 371, pl. 12, f. 7, 8, 1853. Moorea = simulans?

† P. EXPANSA Pse., A. J. C., vii. p. 26, pl. 9, f. 3, 1871. Tutuila, Brazier, type in A. N. S. ex auctore. An examination of the animal and embryo of this species is necessary to establish its claim to a place in the genus Partula.

P. *extensa* Pse., P. Z. S., p. 473, 1871. This is an error in name for P. expansa. See Pfr. Mon. Helic., viii. p. 204.

† P. FABA Martyn (Limax), Universal Conch., ii. p. 67, central figs., 1784. Raiatea, Garr.

† P. *fasciata* Pse., A. J. C., ii. p. 202, 1866. Marquesas, Garr. = P. Ganymedes small var.

† P. FILOSA Pfr., P. Z. S., p. 262, 1851. Tahiti, Garr. Navigator's Isls., Cox.

† P. FORMOSA Pse. Mss., Coll. Pse. Raiatea, Garr. This shell is common in collections, and by Cuming was considered to = P. dentifera. It is a much larger and finer colored shell than P. dentifera, from which it is doubtless distinct. The latter is always much smaller, of a greenish-yellow color, with a yellow apex, while P. formosa is always pale reddish, or orange red, with a dark red apex.

† P. FUSCA Pse., A. J. C., ii. p. 193, 1866. Raiatea, Garr. The types of P. fusca in the Museum of Comparative Zoölogy are young, immature shells, and = P. ovalis and P. lugubris, as generally found in collections. When large quantities of the above species are compared with P. protea Pse., they may be arranged in the following order, from the junior to the adult shell: P. lugubris = P. ovalis = P. protea = P. fusca. Some well-grown P. fusca are as large as examples of P. faba, which they somewhat resemble. In the Smithsonian collection, P. fusca is marked as equalling P. faba. This, however, is an error, as P. faba is arboreal, while P. fusca is terrestrial. These varieties of P. fusca are all terrestrial, and all inhabit the island of Raiatea.

† P. GANYMEDES Pfr. (Bul.), P. Z. S., p. 39, 1850; also Conch. Icon. Mon. Part., species 16, pl. 3, f. 16, 1846. Dominique, Marquesas, Garr.

† P. GARRETTII Pse., P. Z. S., p. 672, 1864. Raiatea, Garr.

† P. GIBBA Fér., Prod., p. 66, No. 3, 1822; also Conch. Icon. Mon. Part., species 15, f. 15^a, 15^b. Island Guam.

† P. *globosa* Pse. Mss., Coll. Pse., Mus. Godeff. Cat., v. p. 207. Raiatea, Garr. = P. Hebe var.

† P. GLUTINOSA Pfr., P. Z. S., p. 85, 1852. Navigator's Islands, Solomon's Island, Cox.

† P. *gonocheila* Pfr. (Bul.), Zeit. fur Malacol., p. 82, 1847; also Conch. Icon. Mon. Part., species 19, pl. 4, f. 19, 1850 = P. Ganymedes. I possess a shell said to be from Dominique, the exact counterpart of Reeve's figure, color included. This shell does not agree with specimens of P. gonocheila in the British Museum, or with the figure of P. gonocheila in Chemnitz. I am at a loss to account for the discrepancy, unless it is to be found in a habit of Cuming, substituting what he considered better specimens for those already in the British Museum collection. My shells are certainly P. Ganymedes.

† P. *gracilis* Pse., A. J. C., ii. p. 197, iii. p. 81, pl. 1, f. 3, 1866–67 = P. attenuata.

† P. *gracilior* Pse. Mss., specimens in A. N. S. Isabel Island = P. gracilis.

† P GRISEA Lesson (Bul.), Voy. Coquill., xiii. p. 325, pl. 13, f. 11, 1829. New Guinea. I often receive this shell from correspondents and others as P. Coxi. My shells all agree with the figure and description of P. grisea.

† P. GUAMENSIS Pfr. (Bul.), Phil. Abbild. und Beschreib. Conch., ii. p. 113, pl. 4, f. 9, 1821. Guam, Ladrone Islands. The spiral rows of foveæ at the apex of the shells of all Partulæ, both embryo and adult, are not visible on the embryos of this species sent to me from the Museum of Comparative Zoölogy, which, in the absence of an examination of the animal, leads me to doubt its being a true Partula.

† P. HEBE Pfr. (Bul.), r. Z. S., p. 39, 1846. Reeve, Mon. Part., species 25, pl. 4, f. 25, 1850. Raiatea, Garr.

† P. HYALINA Brod., P. Z. S., p. 32, 1832. Tahiti = Mauguaia, Garr. Rurutu, Le Cage. Tumaco, Cuming.

† P. *Huahinensis* Garr. Mss., Mus. Godeff. Cat., v. p. 92, 1874. Huaheine, Garr. = P. varia var.

† P. IMPERFORATA Pse. Mss., Mus. Godeff. Cat., v. pp. 92, 207, 1874. Raiatea, Garr.

† P. INFLATA Rve., P. Z. S., p. 197, 1842; also Rve., Mon. Part., species 3, f. 3^a, 3^b, 1849. Dominique, Marquesas, Garr.

† P. *Isabellina* Pfr. (Bul.), P. Z. S., p. 39, 1846. Rve., Mon. Part., species 10, f. 8^b, 1849 = P. Otaheitana var. Tahiti.

† P. *labiata* Pse. Mss., Mus. Godeff. Cat., v. p. 207, 1874 = P. dentifera Raiatea.

† P. LÆVIGATA Pfr., P. Z. S., p. 334, 1856.

P. *Leucothoë* O. Semp., J. C., xiii. p. 419, pl. 12, f. 5, 1865. Peleliu; see P. Calypso.

† P. LIGNARIA Pse., P. Z. S., p. 671, 1864. Tahiti, Garr. This shell very nearly approximates, if it is not identical with, P. affinis. I have arrived at this conclusion after the examination of a quart of each variety.

P. LINEATA Lesson (Bul.), Voy. Coquill., p. 324, pl. 7, f. 8, 9, 1826. Oualan, Friendly Islands. This species has been erroneously referred to P. vexillum. I regard it as differing from all others with which I am acquainted.

† P. *lilacina* Pfr. (Bul.), P. Z. S., p. 334, 1856. Bora-bora Isl. = P. lutea. Through the kindness of Edgar A. Smith, F. Z. S., of the British Museum, I have been enabled to establish the true position of this species. P. lilacina Pfr. is a highly colored specimen of P. lutea Less.; while P. solidula Rve., as figured in his Monograph of Partula, is a large and fully developed specimen of P. lutea without color.

† P. *lineolata* Pse., A. Z. C., iii. p. 224, 1867. Tahiti, Garr. = P. filosa. The type of P. filosa in the Brit. Mus. confirms the identity of P. lineolata with P. filosa.

† P. LIRATA Mouss., J. C., xviii. p. 126, 1870 Tavinu, Viti Isles, Garr.

P. *lugubris* Pse., P. Z. S., p. 672, 1864. Raiatea, Garr. = P. fusca Jr.; see P. fusca.

† P. LUTEA Less., Voy. Coquill., p. 325, 1856. Bora-bora Isl., Garr.

† P. MACGILLIVRAYI Pfr., P. Z. S., p. 97, 1855. Annietium Isl., New Hebrides, Cox. This shell is described and figured from a large ventricose and weather-beaten example.

† P. *marginata* Garr. in litt. Tahaa, Garr. = P. faba var.

† P. *Mastersii* Pfr., P. Z. S., p. 110, 1857. Guam, Ladrone Islands, Dr. Masters = P. gibba var.

P. *maura* Grateloup, Actes Soc. Linn. Bordeaux, xi. pl. 12, f. 4, 1837 = P. Otaheitana original var.

† P. MICANS Pfr., P. Z. S., p. 138, 1852. Solomon's Isl., Dr. Cox. This is the smallest Partula known, being much less than P. minuta Pfr.

† P. *megastoma* Pse. Mss., Mus. Godeff. Cat., v. p. 92, 1874. Raiatea, Garr. = P. callifera.

† P. *microstoma* Pse. Mss., Coll. Pse. type = P. vittata Pse. without a pillar tooth.

† P. MOOREANA W. D. Hart., P. A. N. S., p. 229, 1880. Moorea, Garr. Coll. A. N. S. and Mus. Comp. Zoöl.

† P. *mucida* Pfr., P. Z. S., p. 98, 1855. The type of this shell in the British Museum = a large dark specimen of P. varia.

P. MINUTA Pfr., P. Z. S., p. 384, 1856. Admiralty Island. This species is more globose than any other described Partula.

P. NAVIGATORIA Pfr. Mss., Rve., Mon. Part., species 21, pl. 4, f. 21, 1849. Raiatea, Garr.

† P. *nitens* Pfr., P. Z. S., p. 293, 1854. New Hebrides, Taylor coll. This shell only differs from specimens of P. affinis in possessing a broad, light band, beginning at the base, and becoming narrower towards the apex; it has the form, button-like pillar tooth, and polished surface of P. affinis. A similar specimen occurred amongst the Pease duplicates of P. affinis from Tahiti.

† P. NODOSA Pfr., P. Z. S., p. 262, 1851. Tahiti, Samoa, Garr. Specimens of this shell in A. N. S. Phila. ex auctore from Tahiti = dark specimens of P. trilineata Pse. Some have a broad white band beneath the suture, which is extended to the base of the shell; others are dark fuscous, with a narrow white line beneath the suture; the latter agree with the figure of P. nodosa in Chemnitz.

† P. *nucleola* Pse. Mss., Mus. Godeff. Cat., v. p. 92, 1874. Coll. Pse. Moorea, Garr. This shell equals short depauperated specimens of P. spadicea.

P. OBESA Pse., A. J. C., iii. p. 223, pl. 15, f. 12, 1867. Islands Fortuna and Vavao, Gräff. The figure of Mr. Pease resembles a Bulimus; the type specimen in the Pease collection is lost.

† P. OTAHEITANA Brug., Ency. Method., i. p. 347, No. 84, 1792. Tahiti. The original description of this shell calls for "a heavy brown sinistral shell, oblong, ovate, perforate, aperture semiovate, unidentate." Mr. Garrett informs me that this variety occurs near the old anchorage, and is probably the original type. Large quantities of this shell exhibit all the varieties merging into each other. Small dextral specimens are often confounded with P. affinis. On the other hand, large, well-developed sinistral specimens, with or without a dentile, as P. Reeve-

ana, P. Isabellina, and P. Pacifica, have been regarded as separate species. The sinistral forms have not been less fortunate in adding to the confusion in synonymy; they vary in size and color in an equal degree with the dextral. The synonyms of P. Otaheitana Brug. may be enumerated in the order of seniority as follows: P. Otaheitana, P. Vanikorensis, P. maura, P. Tahulana, P. Isabellina, P. amabilis, P. rubescens, P. Reeveana, P. Pacifica, P. Tahitana; manuscript species, P. sinistrorsa, P. crassa, P. sinistralis, P. brevicula, P. perversa, P. turricula, Pse. Mss. (non Pse. in A. J. C.).

† P. *ovalis* Pse., A. J. C., ii. p. 194, 1866. Raiatea = P. protea. See P. fusca.

† P. *Pacifica* Pfr., P. Z. S., p. 125, 1854. This species probably = a large dextral P. Otaheitana without a pillar tooth.

† P. *pallida* Pse., Mss. Coll. Pse. = a pale elongate variety of P. faba.

P. Peasii Cox, P. Z. S., p. 644, pl. 52, f. 2, 1871. Solomon's Island, Dr. Cox.

† P. *peraffinis* Psc., Mss. Mon. Helicien, viii. p. 197 = P. elongata (Pfr.).

† P. *perversa* Pse., Mss. Coll. Pse., Coll. Brit. Mus. = P. Otaheitana sinistral.

† P. *perplexa* Pse., Mss. Coll. Pse., Huaheine = P. varia var. This is one of the most beautiful varieties of P. varia. I only detected five specimens in several quarts of P. varia from Huaheine.

P. pellucida Pse., P. Z. S., p. 457 = 1871. Guadeleamar, Solomon's Island. "A small shell with a distinctly granular surface" (Pse.), possibly a Bulimus.

† P. *Pfeifferi* Cross, J. C., xix. p. 184, 1871. Vanna-Levu, Banks Island, New Hebrides = P. Caledonica.

† P. *pinguis* Garr., Mss. in litt. The form of aperture resembles P. rustica, but in size it approximates P. Thalia. It is a terrestrial species, and probably = P. rustica.

† P. planilabrum Pse., P. Z. S., p. 672, 1864. Coll. Psc. Tahaa, Garr.

† P. producta Pse., P. Z. S., p. 671, 1864. Tahiti, Garr. This is a terrestrial species, and may be confounded with dextral banded P. Otaheitana without a pillar tooth.

† P. *propinqua* Pse., Mss. Coll. Pse., Tahaa. Mr. Pease, in a label attached to this species, remarks: "I regard this and P. subangulata as only local varieties of P. faba from Tahaa," — an observation applicable to many other so-called species of Partula.

† P. *protea* Pse., Mss. Mus. Godeff. Cat., v. p. 92, 1874. Raiatea, Garr. = P. fusca var. See P. fusca.

† P. *pulchra* Pse., Mss. Mus. Godeff. Cat., v. p. 92, 1874. Huaheine, Garr. = P. varia, minor form.

† P. *purpurascens* Pfr., P. Z. S., p. 335, 1856 = P. rosea, purple variety.

† P. radiata Pse., Mss. Coll. Pse., Coll. A. N. S., ex auctore. Raiatea, Garr. This is a good species; it has been widely distributed by Mr. Pease and others as P. compressa Pfr. The former possesses very coarse oblique striæ, widely reflected lip, with a keyhole aperture, a pillar tooth, and a slight carination at the periphery; while the latter is a smooth shell, with a slightly reflected lip, and the pillar tooth is absent.

† P. RADIOLATA Pfr. (Bul.), P. Z. S., p. 39, 1849; also Rve. Mon. Part., species 6, pl. ii. f. 6ᵃ, 6ᵇ, 1850. Guam, Cuming. New Ireland, Dr. Cox.

† P. *Raiatensis* Garr. Mss. in litt. Raiatea, Garr. This shell = P. dentifera, with a rose apex. In two quarts of P. dentifera belonging to the duplicates of the Pease collection about one sixth of the number possessed the rose apex; they did not differ in other respects from P. dentifera.

† P. Reeveana Pfr., P. Z. S., p. 137, 1852. Solomon's Island, Dr. Cox. Large dextral specimens of P. Otaheitana from Tahiti, of a yellow color, red apex, and a pillar tooth, agree with types of P. Reeveana in the British Museum, and also with the figure of P. Reeveana in Chemnitz.

† P. *recta* Pse., A. J. C., iv. p. 155, pl. 12, f. 8, 1868. Mountains Mauui and Nukahiva, Marquesas = P. repanda. I possess a number of specimens of this species from the collection of the late William H. Pease. It is very variable in shape, color, and texture. Some specimens are yellowish-white, solid, and covered with a greenish epidermis, easily rubbed off, with a perpendicular aperture, and the inner margin of the aperture waved or roughened. This variety represents P. recta Pse.; others are pale yellow, white, or yellowish-white, often thin and inflated, with the aperture oblique or perpendicular, and slightly roughened; others, again, are pale red, with the basal half several shades deeper in color. These two latter varieties represent P. repanda. In one and a half pints of duplicates in the collection of William H. Pease, the specimens exhibited a perfect inosculation of these apparently dissimilar species.

† P. *recta* Pse. Mss., Raiatea, Garr. Coll. Pse. (non P. recta Pse. in A. J. C.). This shell is also synonymous with P. Peaseana, Garr. Mss. (non Peasii, Cox). = P. labiata Pse. Mss. in A. N. S., ex auctore, which latter = P. dentifera var.

P. *Recluziana* Petit, J. C., v. p. 170, pl. 7, f. 5, 1850 = P. actor.

† P. REPANDA Pfr., P. Z. C., p. 98, 1855. New Hebrides? Dr. Cox. Water-color drawings from types in the British Museum agree with specimens from Marquesas. See P. recta Pse. in A. J. C.

† P. ROSEA Brod., P. Z. S., p. 125, 1832. Huaheine, Garr.

† P. *rubescens* Rve., Mon. Part., No. 12, pl. 3, f. 12, 1850 = P. Otaheitana var.

† P. *robusta* Pse. Mss., Coll. Pse., Coll. Smithsonian, Raiatea, Garr. = P. auriculata var.

P. *rufa* Lesson (Bul.), Voy. Coquill., p. 324, 1830. Oualan, Caroline Islands. Since the publication of my Catalogue of the Genus Partula Fér. in May of this year, and while the present Bibliographic Catalogue was in press, Prof. von Martens has published in Conchologia Mittheilung for 1881 the description and figure of a Partula from the island of Ponape, which he has no doubt is P. rufa Less., and which he makes synonymous with P. Guamensis Pfr. The figures of his shell materially differ in size and form from P. Guamensis Pfr., and, in my opinion, approximate dextral examples of P. Upolensis Mouss. Mss., which = depauperated examples of P. bulimoides Less.; the smaller size, conic form, wide umbilicus, and violet color within, together with other characters enumerated, seem more applicable to the latter than the former species. Unfortunately Lesson never published a figure of P. rufa.

† P. *rustica* Pse., A. J. C., ii. p. 199; id. p. 81, pl. 1, f. 5, 1866–67. Raiatea, Garr. = P. crassilabris. After examining large quantities of these two so-called species, I have arrived at the conclusion that they are one. Typical P. crassilabris is more rounded in form, while P. rustica is more elongate, and the columella is indented from without, giving the aperture an angular appearance. The colors agree, and large numbers of each exhibit the inosculation of the two varieties. They are both terrestrial, from the same island, and doubtless identical.

† P. *semilineata* Mouss., J. C., xvii. p. 337, 1869, Coll. Mus. Godeff. = P. conica, sinistral yellow var.

† P. *sinistrorsa* Pse. Mss., Mus. Godeff. Cat., v. p. 92, 1874. Tahiti, Garr. Coll. Pse. I have considered this shell to = P. Otaheitana, banded var. It certainly inosculates with the original brown P. Otaheitana, as we see examples of the latter with one or two dark bands.

† P. *sinistralis* Pse. Mss., Pätel Cat., p. 104, 1873. Tahiti. Olim P. sinistrorsa?

† P. *simplaria* Morelet, J. C., iv. p. 370, pl. 11, f. 13, 14, 1853. Huaheine = P. rosea var.

† P. *simulans* Pse., A. J. C., vii. p. 202; id., iii. p. 81, pl. 1, f. 1, 1866–67. Moorea, Garr. = P. spadicea var.

† P. *solidula* Rve. Mon. Part., species 2, pl. 4, f. 22, 1850. Bora-bora, Garr. = P. lutea var.

† P. *solidula* Pse. Mss., Coll. Pse. (non Rve.). Raiatea = P. approximata banded var.

† P. *spadicea* Rve., Mon. Part., species 24, pl. 4, f. 24, 1850. Moorea, Garr. Marquesas, Rve. The synonyms of this species I arrange as follows: P. tæniata, P. spadicea, P. elongata, P. simulans, P. striolata, P. nucleola. A microscopic examination of the surface of these varieties exhibits it thickly crowded with waved spiral striæ, exceeding in this respect all other species. A small tubercle is present on the columella of all the varieties, and the junction of the lip with the body whorl presents the appearance of having been cut off obliquely outwards, leaving a sharp elevation, which is seldom surrounded by callus. Large quantities from Moorea exhibit all these varieties, merging into each other. All the varieties exhibit translucent or horn-colored specimens with dark bands of greater or less width, which equal P. tæniata.

† P. *strigata* Pse., A. J. C., iv. p. 155, pl. 12, f. 7, 1863; also Rve. Mon. Part., pl. 3, f. 17. Marquesas? Rve. Huaheine, Garr. Coll. Pse., Coll. A. N. S., ex auctore = P. varia var.

† P. *strigosa* Pfr., P. Z. S., p. 384, 1856. Admiralty Island, Pfr., Moorea = P. suturalis Pfr.

† P. *striolata* Pse., A. J. C., ii. p. 197; id., p. 81, pl 1, f. 4, 1866–67 = P. spadicea var. Moorea.

† P. STENOSTOMA Pfr., P. Z. S., 97, 1855. Moorea.

† P. STOLIDA Pse., A. J. C., ii. p. 198, 1868. Raiatea, Garr. This shell is

sometimes confounded with P. affinis. It is larger than the latter, of a light bay color, and is terrestrial.

† P. *suturalis* Pse. Mss. (non Pfr.) = P. planilabrum, dark var. Tahaa, Garr.

† P. SUTURALIS Pfr., P. Z. S., p. 98, 1855. Moorea.

† P. *subangulata* Pse., J. C., 3d series, p. 458, 1871. Tahaa, Garr. = P. faba var., Coll. Pse., Coll. Smithsonian.

† P. SUB-GONOCHEILA Mouss., J. C., xix. p. 14, pl. 3, f. 4, 1871. Fortuna and Vavao, Gräff.

P. *Tahitana* Brug. (Gould), Conch. U. S. Explor. Exped., i. p. 84, 1849–50 = P. Otaheitana.

P. *Tahulana* Anton, Ant. Verz., p. 40, No. 1470, 1839 = P. Otaheitana.

† P. TÆNIATA, Mörch (Bul.), Cat. Con. Kierulf, p. 29, pl. 1, f. 5, 1840. Fiji Islands, Mörch, Moorea Coll., Pse. Specimens of this shell from Mr. Geale are translucent, with dark bands. I possess numerous similar shells from Moorea. Mörch says: "My shell, together with P. faba, was purchased of a whale-fisher, who gave the locality as Fiji Islands."

† P. *terrestris* Pse. Mss., Coll. Pse., Pätel Cat., p. 104, 1873. Raiatea, Garr. = P. approximata.

P. *Thetis* O. Semp., J. C., xiii. p. 419, pl. 12, f. 6, 1865. Peleliu. See P. Calypso.

P. *Thersites* Pfr. (Bul.), Symbola, ii. p. 52, 1846. Dominique, Tiawata, Marquesas, Garr. = P. inflata.

† P. THALIA Garr., Mss. in litt., Raiatea, Garr. = P. Peasii Garr. Mss. (non P. Peasii Cox) = P. abbreviata Pse., Mss. (non Mousson). This shell has been distributed as P. abbreviata Pse., Mss. It is a good species.

P. *torosus* Beck (Partulus), Beck's Index, p. 87, No. 6, 1837 = P. lineata?

† P. *trilineata* Pse., A. J. C., ii. p. 195; id. iii. p. 81, pl. 1, f. 1, 1866, 1867. Tahiti, Garr. = P. nodosa.

† P. TURRICULA Pse., A. J. C., p. 196, 1872. New Hebrides. Mr. Pease observes that "this shell is smooth, without any trace of transverse striæ." Under a low power the spiral rows of embryonic foveæ at the apex of the shells of all Partulæ (and which, after extrusion, are continued as spiral striæ) in this species, are continued as spiral rows of foveæ over the whole surface, differing in this respect from all other Partulæ with which I am acquainted.

† P. *turricula* Pse., Mss. Coll. Pse. = P. Otaheitana var. rubescens. Tahiti.

P. TURGIDA Pse. (Bul.), P. Z. S., p. 670, 1864. Raiatea, Garr. Mr. Pease remarks: "This shell resembles P. arguta and P. annectens." It is a rare species.

† P. *Turneri* Pfr., P. Z. S., p. 140, 1860. Erromango Island, New Hebrides, Turner = P. Macgillivrayi. The former has been described from a fresh specimen, while the latter was described and figured from an old and weather-beaten specimen, unusually inflated. See P. Brazieri.

† P. UMBILICATA Pse., A. J. C., ii. p. 200; id., iii. p. 81, pl. 1, f. 7, 1866, 1867. Tahaa, Garr.

† P. *Upolensis* Mouss. Mss., Pätel. Cat., p. 104, 1873. Upolu Coll., A. N. S.

= P. bulimoides. I possess this shell from the Museum Godeffroy. It = a small, dark P. bulimoides. In Europe the typical P. bulimoides is called P. canals, the small dark variety P. Upolensis, the sinistral greenish-yellow variety P. conica. These, however, are only varieties of one species, and are all embraced in Dr. Gould's description of P. conica "interdum sinistrorsa flavida vel castanea." Like P. repanda, they are found only on mountains.

† P. VARIA Brod., P. Z. S., p. 125, 1832. Huaheine, Garr. The following synonyms of this species are enumerated in the order of seniority: P. mucida, P. assimilis, P. strigata; manuscript species, P. pulchra, P. Cookiana, P. perplexa, P. Huaheinensis, P. bicolor, Garr. (non Pse.).

P. *Vanicorensis* Quoy et Gaim (Helix), Voy. Astrolabe, ii. p. 115, pl. 9, f. 12–17, 1830. The original description and figure of this shell agree with dextral specimens of P. Otaheitana, without a denticle. In collections it is sometimes represented by P. affinis, and in others by P. Otaheitana. Dr. Gould says, "It only differs from P. Otaheitana in the lighter color of the animal."

† P. *variabilis* Pse., A. J. C., ii. p. 203; id., p. 81, pl. 1, f. 13–15, 1866–67. Raiatea, Garr. = P. Navigatoria. This shell is the true P. Navigatoria Pfr., agreeing with Reeve's figure and description, as well as with the types of P. Navigatoria in the British Museum. Dr. Pfeiffer says, "My Navigatoria in the British Museum was by Cuming confounded with another shell." From a number of specimens in the Pease collection, labelled "P. Navigatoria Pfr., from the British Museum," I infer that P. protea is the shell alluded to by Pfeiffer. The possession of these doubtless led Mr. Pease to redescribe this shell.

† P. *ventrosa* Garr., Mss. in Litt. Raiatea, Garr. = P. Hebe var.

† P. *ventricosa* Pse., Mss. Coll. Pse., Tahaa = P. faba var. (Anthony).

† P. *vexillum* Pse., A. J. C., ii. p. 198; id., iii. p. 81, pl. 1, f. 8, 1866–67. Moorea, Garr. Reeve figures this shell for P. lineata Lesson; others confound it with P. elongata Pse. It = P. stenostoma Pfr. See Pfeiffer's Novitates Conchologicæ.

† P. VITTATA Pse., A. J. C., ii. p. 194, 1866. Raiatea, Garr.

† P. VIRGINEA Pse. Mss., Coll. Pse. Tahaa, Garr.

† P. VIRGULATA Pse., J. C., 3d series, x. p. 401, 1870. Raratonga, Garr.

† P. *zebrina* Gould, Proc. Bost. Soc. Nat. Hist., vii. p. 196, 1842. Tutuila, Gould, Upolu, Garr., Belcher Island, Coll. Taylor = P. actor. Dr. Gould's type of this shell is preserved in the collection of the New York State Museum of Natural History and also in the Smithsonian collection. The figures of this shell in "Expeditionary Mollusks" are dissimilar; figure 80 is probably an error; figure 81, containing the animal, is the true P. zebrina.

The following species and varieties, so far as known, are Terrestrial; all others are Arboreal.

P. approximata Pse.
P. castanea Garr. Mss.
P. crassilabris Pse.
P. fusca Pse.
P. lugubris Pse. Mss.
P. microstoma Pse. Mss.
P. Navigatoria Pfr.
P. ovalis Pse. Mss.
P. pinguis Garr. Mss.
P. planilabrum Pse.
P. protea Pse. Mss.
P. producta Pse.
P. radiata Pse. Mss.
P. robusta Pse. Mss.
P. rustica Pse.
P. solidula Pse. Mss., non Reeve.
P. stolida Pse.
P. terrestris Pse. Mss.
P. variabilis Pse.
P. vittata Pse.

SPURIOUS SPECIES OF PARTULA.

P. arcuatus Mighls. = Achatinella auriculata Fér.
P. auriculata Pfr. = Tornatella.
P. Batavia Grat. (Bul.) = Amphidromus.
P. decussata Pfr. = (Bul.).
P. densilineata Rve. = Achatinella radiata Gould.
P. Dumartroy Soul. = Achatinella auriculata Fér.
P. fragilis Ferr. = Bul. rubens Muhlf.
P. flavescens King. = Bul.
P. labrella Grat. = Bul. virgatus Jay.
P. major Desh. = Bul. fulvicans Pfr.
P. Maximilliana Pot et Michd. = Bul.
P. pusilla Gould = (Auriculella).
P. pudica Fér. = Bul.
P. Solomonis Pfr. = (Bul.).
P. unidenta Sowb. = (Bul.).
P. virgulata Mighls. = (Achatinella).

Observations on the Duplicates of the Genus PARTULA Fér., *contained in the Museum of Comparative Zoölogy, Cambridge, Mass., formerly belonging to the Collection of the late William H. Pease.* By WILLIAM DELL HARTMAN, M. D.

SINCE the completion of my Bibliographic Catalogue of the Genus *Partula*, through the kindness of Prof. Alexander Agassiz of the Museum of Comparative Zoölogy, I have been favored with all the duplicates of *Partula* belonging to the institution, amounting to two bushels. An inspection of this vast amount of material has afforded me a rare opportunity of observing the relative abundance and variation of a number of species, and the notes taken at the time I offer as a supplement confirmative of the conclusions arrived at in the paper above mentioned. The original labels belonging to the different parcels were often misplaced or absent. These omissions were of no moment, as a previous study of all the species enabled me to determine the specific status of each parcel.

P. varia and *P. rosea* Brod., together with *P. faba* Mart., were in the greatest abundance, and for relative numbers were present in the order mentioned.

P. varia Brod., represented by six quarts, exhibited all the varieties mentioned by authors, all of which, however, are included by Mr. Broderip under the expressive name of *P. varia.*

P. rosea Brod. was next in abundance, in which the elongated white variety = *P. cognata* Pse. Mss. largely predominated over the rose, purple, and party-colored varieties. From the great number of examples of these two species they would seem to be very abundant.

In four quarts of *P. faba* Mart. the white and oblique striated varieties predominated over the banded variety, which latter = Martyn's type.

P. dubia Garr. Mss. was represented by two quarts. The specimens are all somewhat smaller than typical *P. faba*, always dentate, and occasionally one exhibits the brown bands of *P. faba* var. *Amanda* Garr. Mss.

P. formosa Pse. Mss., *P. lugubris* Pse., *P. Garrettii* Pse., and *P. Thalia* Garr. Mss. were next in abundance and in the order mentioned. *P. Thalia* and *P. formosa* are doubtless good species, although Mr. Cuming regarded the latter as a variety of *P. dentifera* Pfr.

P. Thalia Garr. Mss., in two quarts, was very uniform in size and color.

P. compacta Pse., in two quarts, was also uniform as to size and color. It is a much larger and heavier shell than *P. auriculata* Brod., with a heavy flat lip, and, like *P. Thalia*, it is a well-marked species.

P. auriculata Brod., in one quart, exhibited the light, unicolored, and banded varieties in about equal numbers.

P. compacta Pse., *P. Thalia* Garr. Mss., and *P. auriculata* Brod., all possess, in a greater or less degree, the "keyhole aperture," which Mr. Broderip regarded as especially characterizing *P. auriculata*. They form a group of very nearly allied species. In *P. Garrettii* Pse., about one third of the examples exhibited the shell with a brown-colored base.

A number of depauperated examples were also present in the parcel, beside several hybrids between *P. Garrettii* Pse. and *P. Thalia* Garr. Mss. These possessed the brown base of *P. Garrettii*, with the form and aperture of *P. Thalia*, but were only half the size. I received a number of the same from Mr. Garrett.

P. crassilabris Pse. and *P. rustica* Pse. were each represented by about one quart of specimens. For the most part the former were smaller and more globose than the latter. Both parcels presented numerous depauperated examples. When compared in quantity, they are seen to merge into each other by easy grades; only the extremes in form represent the two species of Mr. Pease. They are both terrestrial, and inhabit the same island, their variation being due to station and food plants. Two examples of *P. pinguis* Garr. Mss. were found in the lot of *P. rustica*. The former is doubtless only a well-fed specimen of the latter.

P. lignaria Pse. and *P. affinis* Pse. were each represented by a quart of examples; a few of each were banded. The variety *P. lignaria* as a rule is a trifle larger and darker in color, and presents more banded examples, than *P. affinis*. All the adult shells of both varieties (with few exceptions) are dentate, and both exhibit, to a greater or less extent, dark oblique striæ on the body whorl.

The parcel *P. affinis* Pse. was labelled "Faarumaia Valley, Tahiti"; about fifty examples to the quart were banded. Several albinos were present, two of which showed traces of dark bands, and a few pale examples occurred with a bright brown band continued beneath the suture to the apex. One example was found the counterpart of my specimens of *P. nitens* Pfr. from the Taylor collection, said to be from New Hebrides; and three similar banded examples were found in the lot of *P. lignaria*.

I regard these as varieties of one species; they all possess a small elevation on the columella, with a round button-shaped pillar tooth. They vary in size somewhat, but the dark oblique striæ exist, to a greater or less degree, in nearly all examples. The surface in fresh shells is always polished, looking as though oiled.

From all the examples of *P. rufa* Less., *P. nitens* Pfr., *P. lignaria* Pse., and *P. affinis* Pse., which I have seen, I am inclined to consider them varieties of one species.

P. glutinosa Pfr., in one quart, was uniform in size and color; and so was *P. virgulata* Pse. in the same amount from Raratonga. *P. elongata*, *P. simulans*, *P. striolata*, and *P. nucleola* Pse., from the island of Moorea, were present in several pints, and doubtless belong to one species, only varying in size and color, the two last being only depauperated examples of the first. Under the microscope all exhibit the thickly crowded waved spiral striæ, and all the varieties show the translucent and banded examples which = *P. tæniata* Mörch. *P. elongata* Pse., in half a pint, shows the most numerous banded examples. There were present numerous pale yellow elongated specimens, which dealers send out as *P. spadicea* Rve. In the parcel of *P. simulans* Pse., the banded examples equalled ten per cent.

P. nucleola Pse. Mss. exhibited several very dark opaque examples.

All the above varieties from Moorea possess to a greater or less degree the dark oblique striæ, the elevation on the columella, the sharp oblique juncture of the labium with the body whorl, and the thickly crowded spiral striæ of the surface of the shell. The latter feature is seen in no other species except *P. Mooreana* nobis, from the same island.

P. Hebe Pfr., in half a pint, exhibited nearly all the examples entirely denuded of epidermis, and without a rose apex, the specimens being entirely white and solid. These represent the typical *P. Hebe.*

P. bella Pse. Mss. = *P. rosea* var. (according to Mr. Garrett). In almost a pint, the shells possessed a rose apex and were thinner than typical *P. Hebe.* The epidermis of some of the heavier examples was thin and readily separated from the shell. Many of the more mature specimens were without epidermis. They only differ from *P. Hebe* in possessing the rose apex, and the lot exhibited the easy grade by which the latter merges into the former. A few specimens of *P. globosa* Garr. Mss. and *P. ventrosa* Pse. Mss. were found in the parcel. These varieties are more stout and heavy than ordinary examples of *P. bella.* They possess a heavy and more adherent epidermis, with little or no color at the apex. All the varieties from *P. Hebe* to *P. ventrosa* present an elongated pillar tooth similar in shape, and all have a slight dentiform process on the columella. I possess a typical *P. Hebe* from Mr. Garrett, in which the color of the apex is centred in the pillar tooth, and another in which the whole shell is a pale rose color. These are all varieties of one species resulting from station and food plants.

Since the above was written Mr. G. W. Tryon has called my attention to four specimens of *Partula* in the collection of the Academy of Natural Sciences received a long time ago from Mr. Pease, and labelled by him *P. bella* Pse. The examples = *P. Amanda* Garr. Mss. = *P. faba* var. This it would seem is the true *P. bella* Pse. Mss., so named long anterior to the date of *P. bella* Pse. = *P. Hebe* var. in Pätel's catalogue.

P. hyalina Brod., in half a pint, was uniform in size, some being thinner and more hyaline than others, probably the result of food and age.

P. lugubris Pse. In a three-pint lot, many examples exhibited the usual white peripheral band; a few almost white examples with a black band were also present. In the adult shell it is noticeable that these bands are often concealed by the overlapping of the fifth whorl. I possess a series of examples of this species which seems to point to the fact that it and *P. fusca*, as usually found in collections, are young and immature shells, the synonymy being such as I have indicated in my Bibliographical Catalogue of the genus.

P. Guamensis Pfr. In two quarts several light-colored examples occurred possessing a narrow brown line at the periphery. Judging from the figure of *P. obesa* Pse. (no locality being given), I suggest the probability that the latter = a depauperated specimen of the former. Some examples of *P. Guamensis* are quite large, while others are much smaller than Reeve's figures. I have not been able to find the type specimen of *P. obesa* Pse. in the Pease collection, and suppose it to have been lost, as some of his types were broken in transit between Honolulu and Boston.

I think, when the animals of *P. Guamensis, P. bulimoides, P. obesa*, and *P. expansa* are examined, they will be eliminated from the genus *Partula*.

P. dentifera Pfr., in two quarts, was very uniform in size, color, and contour. It is a much smaller shell than *P. formosa* Pse. Mss., with a greenish yellow epidermis and yellow apex. About one sixth of the specimens exhibited a rose apex = *P. Raiatensis* Garr. Mss. The variety styled *P. decorticata* Pse. Mss. consists of individuals of *P. dentifera*, in which the epidermis has been denuded by the animals licking the shells of each other after hybernation has ended.

P. trilineata Pse. = *P. nodosa* Pfr., in a half-pint, were all banded and possessed a pillar tooth, except three, which were entirely dark fuscous with a narrow white sutural line; the latter = *P. nodosa* Pfr. type. *P. vexllium* Pse., in a small parcel, exhibited the dark and striated examples with or without bands (= *P. alternata* Pse.), exceeding in numbers the horn-colored shell with narrow brown bands = *P. stenostoma* Pfr. type. These two species of Mr. Pease seem to inosculate. I have received from Mr. Garrett a few very dark examples of *P. alternata* Pse., and he informs me that one in fifty examples of *P. vexillum* Pse. is sinistral.

P. citrina Pse. was present in a small lot. Mr. Pease was of the opinion that this species would eventually prove to be a variety of *P. faba.* In a recent letter from Mr. Garrett, he reiterates his opinion, previously expressed, that *P. citrina* is a good species. In the collection of Mr. Pease, kindly loaned for my inspection by the Museum of Comparative Zoölogy, a few examples were marked *P. pallida* Pse. Mss. These = elongated examples of *P. faba*, which latter is disposed to be somewhat protean, of which *P. citrina* is probably another variety, or, as Mr. Pease suggests, it may be a hybrid.

P. approximata Pse., in a small lot, exhibited one banded to twenty-five unicolored examples. My opinion in regard to this species is the same as expressed in my Bibliographic Catalogue of the genus.

P. imperforata Pse. Mss., in a pint lot, was very uniform in size and color; about half a dozen were banded. It is a larger, heavier, and more inflated shell than *P. virginea* Pse. Mss., and the surface is more roughened by oblique striæ. This shell has been supposed to = *P. solidula* Pse. Mss. (non Reeve). The type examples of *P. solidula* Pse. Mss. in the Pease collection = banded specimens of *P. approximata* Pse. Mss.

In one quart of *P. protea* Pse. the light and striated examples predominated in numbers over the dark and banded varieties. Well fed and fully developed examples approximate *P. faba* in size and form. The colors are often rusty red with a darker base, or uniformly rusty red with a broad light zone at the periphery. This last variety represents type examples from Mr. Garrett and the Museum Godeffroy. In the Smithsonian collection this shell is labelled (probably by Carpenter) *P. faba* Martyn var. The latter, however, is arboreal, while the former is terrestrial. See *P. fusca* Pse. in my Bibliographic Catalogue.

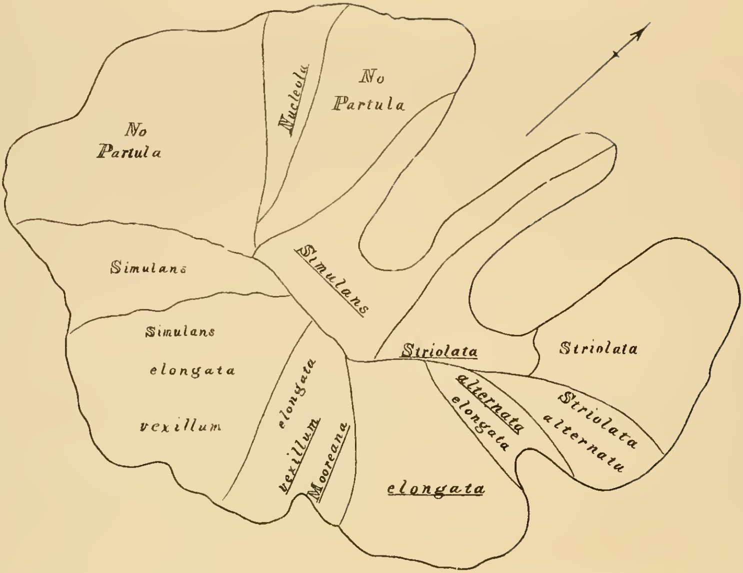
Of *P. Otaheitana* Brug. there were about two quarts; nearly all the examples were sinistral. The type or original unicolored variety was exceeded in number by the banded variety = *P. sinistrorsa* Pse. Mss. All the latter were sinistral, and very few of the former were dextral. From the small number of dextral, as compared with the large number of sinistral examples in the lot, it would seem that the sinistral form in this species is the rule and not the exception, as obtains in some other species of *Partula*.

P. bilineata Pse., in a half-pint of examples, was shown to be a distinct and beautiful species.

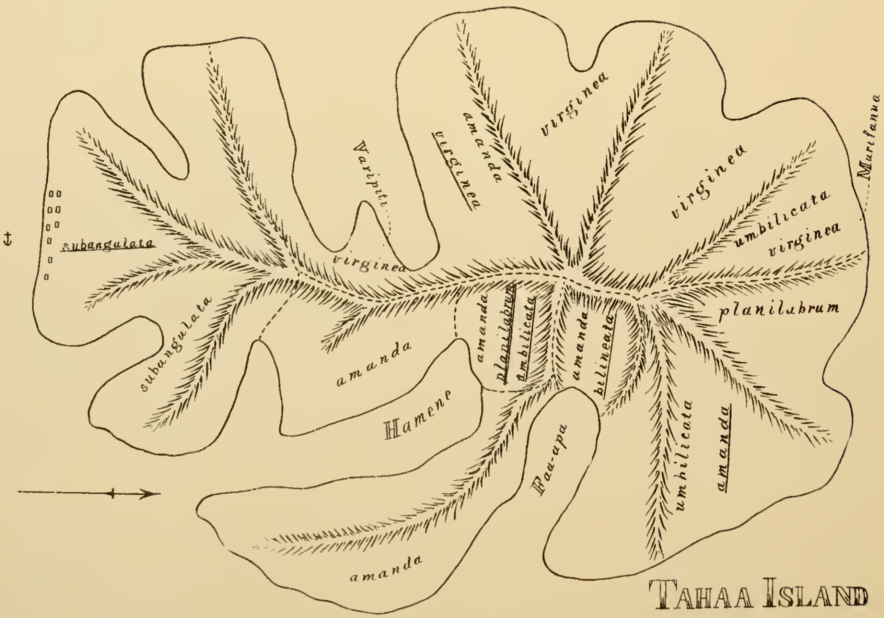
P. radiata Pse. Mss. In one quart of this species about twenty banded specimens occurred which = Mr. Pease's type. The light-colored and striated examples, which Mr. Pease distributed as *P. compressa* Pfr., predominated. This shell and *P. approximata* Pse. possess the keyhole aperture, with a slight carina at the periphery. The latter feature varies in different examples. I can see no difference in these two varieties of terrestrial shells from Raiatea, except that in *P. radiata* the oblique lines of growth are more coärse than in *P. approximata*, and the latter is somewhat darker in color, which in some of the varying species of *Partula* (more especially in the terrestrial varieties) is often referable to station and food plants.

P. lineata Pse. = *P. filosa* Pfr. In one pint of this species from Tahiti, the specimens were all dentate and uniform in size; some were lighter in color than others, but all in a greater or less degree exhibited the ash-colored filiform lines characteristic of the species.

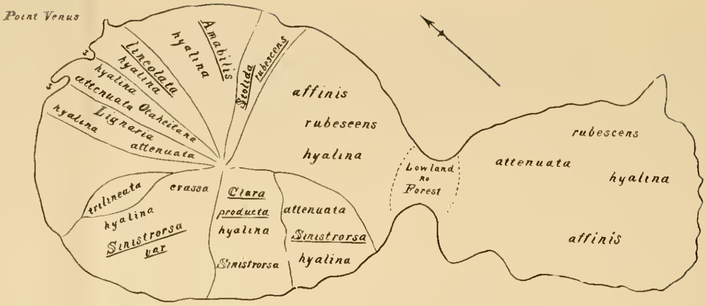
P. repanda Pfr. was represented by one and a half pints. This parcel was labelled by Mr. Pease "*P. recta* Pse. Mountains Nukahiva, Marquesas." The variety *P. repanda* Pfr. predominated in numbers over the variety *P. recta*. Dr. Pfeiffer, in his description of *P. repanda*, quotes New Hebrides as the station for the species, but his localities for *Partula* are so often incorrect or entirely omitted, that I have very grave doubts of the correctness of this one. My examples agree with the types of *P. repanda* Pfr. in the British Museum. For a farther exposition of the two varieties, see *P. recta* Pse. in my Bibliographic Catalogue of the Genus *Partula*.


No
Partula
Nucleola
No
Partula
Simulans
Simulans
Simulans
elongata
vexillum
elongata
vexillum
Mooreana
Striolata
Striolata
alternata
elongata
Striolata
alternata
elongata

MOOREA ISLAND
8-10 miles long

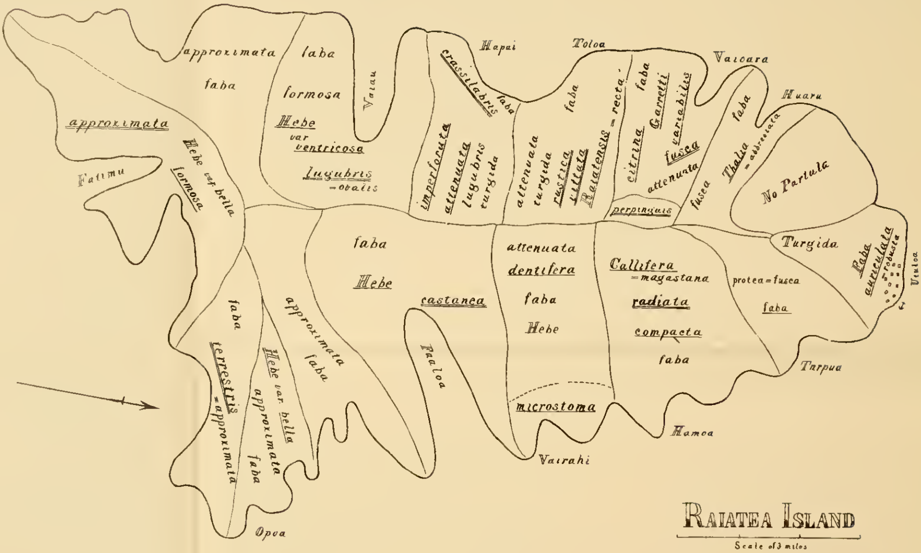

Murifanua
virginea
amanda
virginea
Varipiti
virginea
umbilicata
virginea
planilabrum
subangulata
virginea
subangulata
amanda
amanda
planilabrum
umbilicata
amanda
bilineata
Hamene
Paa-apa
umbilicata
amanda
amanda

TAHAA ISLAND
Scale 2 miles


Point Venus
Amabilis
hyalina
Lineolata
hyalina
hyalina
attenuata Otaheitana
Lignaria
attenuata
hyalina
Stolida
rubescens
affinis
rubescens
hyalina
trilineata
crassa
hyalina
Sinistrorsa
var
Clara
producta
hyalina
Sinistrorsa
attenuata
Sinistrorsa
hyalina
Low land
no
Forest
rubescens
attenuata
hyalina
affinis

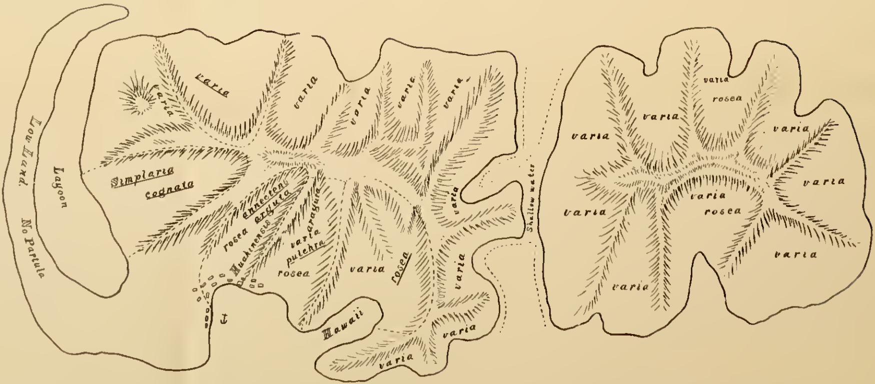
TAHITI ISLAND

40 miles long


approximata
faba
faba
formosa
Hebe
var
ventricosa
Lugubris
=obalis
Vaiau
approximata
Fatimu
Hebe var bella
formosa
crassilabris
faba
Hapai
imperforata
attenuata
lugubris
turgida
attenuata
turgida
rustica
vittata
Raiatensis = recta
faba
Toloa
faba
citrina
Garretti
variabilis
fusca
attenuata
perpinguis
fusca
Vaioara
faba
Thalia
=abbreviata
Huaru
No Partula
faba
Hebe
castanea
attenuata
dentifera
faba
Hebe
Callifera
=magastana
radiata
compacta
faba
Turgida
protea = fusca
faba
Faba
auriculata
= robusta
Utuloa
Tarpua
faba
terrestris
= approximata
Hebe var bella
approximata
faba
approximata
faba
Faaloa
microstoma
Vairahi
Hamoa
Opoa

RAIATEA ISLAND

Scale of 3 miles


Low Land.
No Partula
Lagoon
varia
varia
varia
Simplaria
cognata
rosea
annectens
arguta
Huahinensis
varia
aragua
varia
pulchra
rosea
varia
varia
varia
varia
varia
rosea
varia
varia
Hawaii
varia
varia
Shallow water
varia
rosea
varia
varia
varia
varia
rosea
varia
varia
varia

HUAHINE ISLAND

Scale 2 miles

No. 6. — *Bibliography to accompany "Selections from Embryological Monographs" compiled by* ALEXANDER AGASSIZ, WALTER FAXON, *and* E. L. MARK.

I.

CRUSTACEA.

By WALTER FAXON.

[IT is proposed to issue in the Memoirs of the Museum a "Selection from Embryological Monographs," which will give to the student, in an easily accessible form, a more or less complete iconography of the embryology of each important group of the animal kingdom. This selection is not intended to be a handbook, but rather an atlas to accompany any general work on the subject.

The plates will be issued in parts, as fast as practicable, each part covering a somewhat limited field. The parts devoted to Echinoderms, Acalephs, and Polyps are well advanced, and a beginning has been made for the Crustacea. Occasional appendices may be published, to prevent the plates from becoming antiquated.

The quarto illustrations will be accompanied by a carefully prepared explanation, and by a bibliography, in octavo, to be made as complete as possible. Although a large part of this bibliographical literature may be found in the general works of Kölliker, Balbiani, and Balfour, and in some of the more recent special monographs, a fuller list on special subjects, comprising the scattered references now accessible only with much cost of time and labor, will be convenient for students.

The present Bulletin contains the first instalment of this bibliography. It will be followed at an early date by similar lists for the Echinoderms, the Acalephs, the Polyps, and the Fishes.

ALEXANDER AGASSIZ.

THE embryological literature of the Arthropod groups *incertæ sedis*, viz. *Xiphosura*, *Trilobita*, and *Pycnogonida*, will be found at the end of this list. An asterisk (*) before a title denotes that the work cited has not been seen by me.

December 3, 1881. W. F.]

Agassiz, Alexander.

[On the Development of the *Porcellanidæ*.] *Proc. Boston Soc. Nat. Hist.*, X. p. 222. Oct. 18, *1865*.

(Zoëa of *Porcellana* (*Polyonyx*) *macrocheles* recorded from Newport, R. I.)

Instinct ? in Hermit Crabs. *Amer. Journ. Sci. & Arts* [3], X. pp. 290, 291. Oct. *1875*.

(Habits of young.)

Agassiz, Louis.

Twelve Lectures on Comparative Embryology, delivered before the Lowell Institute, in Boston, December and January, 1848–49. Boston, *1849*. 104 pp.

(Eggs of *Pinnotheres*, p. 67, Pl. XXII. Development of *Palæmon*, pp. 67, 68, Pl. III. *Cumæ* the young of *Palæmon*, *Hippolyte*, and *Mysis*, p. 68.)

Zoölogical Notes from the Correspondence of Prof. Agassiz. *Amer. Journ. Sci. & Arts* [2], XIII. pp. 425, 426, *1852;* XXII. pp. 285, 286, *1856.*

(*Cumæ* the young of *Crangon*, *Palæmon*, and *Hippolyte.*)

Allman [George James].

On the Development of *Notodelphys*, Allm., a new Genus of *Entomostraca. Rep. Brit. Assoc. Adv. Sci. for* 1847, p. 74. *1848.*

Anderson, John.

On the Anatomy of *Sacculina*, with a Description of the Species. *Ann. Mag. Nat. Hist.* [3], IX. pp. 12–19, Pl. I. *1862.*

(Larva, pp. 13, 14, fig. 1.)

Aurivillius, P. O. Christopher.

On a new Genus and Species of *Harpacticida. Bihang till K. Svenska Vetensk.-Akad. Handl.*, V. No. 18. *1879.* 14 pp., 4 pl.

(*Balænophilus unisetus.* Development, pp. 10–15, Pl. III., IV.)

**Balaenophilus unisetus* nov. Gen. et Sp. Ett Bidrag till Kännedomen om Harpacticidernas Utvecklingshistoria och Systematik. Stockholm, *1879.* 26 pp., 4 pl. (Akadem. Afhandl.)

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Previously in *Mag. Zoöl. Bot.*, I. pp. 35–41, 309–333, 514–526, Pl. VIII.–X., XVI., *1837;* II. pp. 132–144, 400–412, Pl. V., *1838. Ann. Nat. Hist.*, I. pp. 245–256, Pl. IX., *1838. Ann. Mag. Nat. Hist.*, XI. pp. 81–95, Pl. II., III., *1843.*

(Young stages, *passim.*)

Balbiani [G.].

Observations relatives à une Note récente de M. Gerbe, sur la Constitution et le Développement de l'Œuf ovarien des Sacculines. *Comptes Rendus de l'Acad. des Sci., Paris,* LXVIII. pp. 615–618. *1869.*

Sur la Constitution et le Mode de Formation de l'Œuf des Sacculines. *Comptes Rendus de l'Acad. des Sci., Paris,* LXIX. pp. 1320–1324. *1869. Ann. Mag. Nat. Hist.* [4], V. pp. 303–306. *1870.*

Sur la Constitution et le Mode de Formation de l'Œuf des Sacculines. Remarques concernant une Note récente de M. Ed. Van Beneden. *Comptes Rendus de l'Acad. des Sci., Paris,* LXIX. pp. 1376–1379. *1869.*

Balfour, Francis M.

A Treatise on Comparative Embryology. Vol. I. Chapter XVIII. Crustacea. Pp. 380–443. London, *1880.*

(General work.)

Bate, C. Spence.

Notes on Crustacea. *Ann. Mag. Nat. Hist.* [2], VI. pp. 109–111, Pl. VII. *1850.*

(On the mode of escape of *Pagurus* larva from the egg, p. 111.)

On the Development of the *Cirripedia*. *Ann. Mag. Nat. Hist.* [2], VIII. pp. 324–332, Pl. VI.–VIII. *1851.*

On the British *Edriophthalmia*. Part I. The *Amphipoda*. *Rep. Brit. Assoc. Adv. Sci. for* 1855. *1856.*

(On the development of the young, pp. 55, 56.)

On the British *Diastylidæ*. *Ann. Mag. Nat. Hist.* [2], XVII. pp. 449–465, Pl. XIII.–XV. *1856.*

(On the development, p. 463. Zoëa of *Hippolyte varians*, pp. 461, 462, Pl. XV. fig. 8.)

On the Development of *Carcinus Mænas*. *Proc. Roy. Soc. London,* VIII. pp. 544–546. *1857.*

(Abstract of paper given in full in *Phil. Trans. Roy. Soc. London*, CXLVIII.)

On the Genus *Cuma*. *Ann. Mag. Nat. Hist.* [2], XIX. pp. 106, 107. *1857.*

(On the affinity of *Cumæ* with young *Macroura*.)

On *Praniza* and *Anceus*, and their Affinity to each other. *Ann. Mag. Nat. Hist.* [3], II. pp. 165–172, Pl. VI., VII. *1858.*

On the Development of Decapod Crustacea. *Phil. Trans. Roy. Soc. London,* CXLVIII. pp. 589–605, Pl. XL.–XLVI. *1859.* (Received May 1, read June 18, 1857.)

(Development of *Carcinus Mænas*.)

On the Morphology of some *Amphipoda* of the Division *Hyperina*. *Ann. Mag. Nat. Hist.* [3], VIII. pp. 1–16, Pl. I., II. *1861.*

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[Review of Fritz Müller's *Für Darwin*.] *Rec. Zoölog. Lit.* (1864), I. pp. 261–270. *1865.*

[Review of Z. Gerbe's *Métamorphoses des Crustacés marins*.] *Rec. Zoölog. Lit.* (1865), II. pp. 321, 322. *1866.*

Report of the Committee appointed to explore the Marine Fauna and Flora of the South Coast of Devon and Cornwall. No. 1. *Rep. Brit. Assoc. Adv. Sci. for* 1865. *1866.*

(*Glaucothoë* the young of *Pagurus*, p. 53.)

Also published with title, Carcinological Gleanings, No. II., in *Ann. Mag. Nat. Hist.* [3], XVII. p. 26. *1866.*

Carcinological Gleanings. No. III. *Ann. Mag. Nat. Hist.* [4], I. pp. 442–448, Pl. XXI. *1868.*

(Believes *Alima* to be the second stage of *Squilla*. Young of *Uca*, see CUNNINGHAM, ROBERT O.)

Report of the Committee appointed to explore the Marine Fauna and Flora of the South Coast of Devon and Cornwall. No. 2. *Rep. Brit. Assoc. Adv. Sci. for* 1867. *1868.*

(Larvæ of *Porcellana*, *Pagurus*, *Palinurus*, pp. 279-282, Pl. I., II.)

Also published with title, Carcinological Gleanings, No. IV., in *Ann. Mag. Nat. Hist.* [4], II. pp. 113-117, Pl. IX., X. *1868.*

Fourth Report on the Fauna of South Devon. *Rep. Brit. Assoc. Adv. Sci. for* 1872. *1873.*

(Observation on the development of *Homarus*, &c., p. 52.)

Report on the Present State of our Knowledge of the Crustacea. Parts I. and II. On the Homologies of the Dermal Skeleton. *Rep. Brit. Assoc. Adv. Sci. for* 1875, pp. 41-53, Pl. I., II. *1876.* *Do. for* 1876, pp. 75-94, Pl. II., III. *1877.*

(Remarks on development, *passim.*)

On the Nauplius Stage of Prawns. *Ann. Mag. Nat. Hist.* [5], II. pp. 79-85. *1878.*

(Thinks Fritz Müller's "*Peneus*-nauplius" may be a larval Schizopod or parasitic Suctorian. Larva of *Galatea* noticed, p. 82.)

Report on the Present State of our Knowledge of the Crustacea. Part IV. On Development. *Rep. Brit. Assoc. Adv. Sci. for* 1878, pp. 193-209, Pl. V.-VII. *1879.*

(*Gelasimus*, *Trapezia*, *Dromia*, *Porcellana*, *Galatea*, *Astacus*, *Crangon*, *Palæmon*, &c.)

Report on the Present State of our Knowledge of the Crustacea. Part V. On Fecundation, Respiration, and the Green Gland. *Rep. Brit. Assoc. Adv. Sci. for* 1880, pp. 230-241. *1880.*

(Account of recent observations of CHANTRAN, GERBE, WILLEMOES-SUHM, &c.)

On the *Penæidea.* *Ann. Mag. Nat. Hist.* [5], VIII. pp. 169-196, Pl. XI., XII. *1881.*

(Genus *Euphema* M. Edw. a young form of *Peneus?* p. 192.)

Bate (C. Spence) and Müller (Fritz).

The Nauplius Stage of Prawns. *Ann. Mag. Nat. Hist.* [5], II. pp. 426, 427. *1878.*

Bate, C. Spence [and Power, Wilmot Henry].

On the Development of the Crustacean Embryo, and the Variations of Form exhibited in the Larvæ of thirty-eight Genera of Podophthalmia. *Proc. Roy. Soc. London*, XXIV. pp. 375-379. *1876.* *Ann. Mag. Nat. Hist.* [4], XVIII. pp. 174-177. *1876.*

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(Observations on development, pp. xliii.-xlvi., *1868* (C. S. Bate), *et passim.*)

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Beneden. *See* **Van Beneden.**

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(Some notes on young, *passim.*)

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Amphion und *Polycheles* (*Willemoesia*). *Zoolog. Anzeig.*, II. pp. 256–259. May, *1879.*

(*Amphion* the larva of *Polycheles?*)

Studier over Decapodernes Slægtskabsforhold. Avec un Résumé en français. *K. Danske Vidensk. Selsk. Skr.* [6], *naturvidensk. og mathemat. Afd.* I. pp. 25–210, 7 pl. *1880.*

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Histoire Naturelle des Crustacés. Paris, *1802.*

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Brandt, Eduard.

Ueber die Jungen der gemeinen Klappenassel (*Idothea entomon*). *Bull. Acad. Impér. des Sci. de St.-Pétersbourg*, XV. pp. 403–409 (*Mélanges Biologiques*, VII. pp. 649–657), 1 pl. *1870*.

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Beiträge zur Kenntniss der Phyllopoden. *Sitzungsber. d. kais. Akad. d. Wissensch. Wien. Math.-naturw. Cl.*, LXV. pp. 279–291. *1872*.

Abstr. *Anzeiger d. Akad. d. Wissensch. Wien*, May 31, 1872, p. 100. *Ann. Mag. Nat. Hist.* [4], X. p. 152, *1872*. **Zeitschr. gesammt. Naturwissen.* [2], VI. pp. 314, 315, *1872*.

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(Young, p. 325, Pl. VI. figs. 17, 18.)

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Fauna del Regno di Napoli, &c. Napoli, *1829, et seqq.*

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A few plates are missing from the copy of this work in the library of the Museum of Comparative Zoölogy. According to Leuckart, *Arch. f. Naturgesch., 1859,* 1, p. 246, the embryo of *Notopterophorus* is figured.

Coste [P.].

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(*Phyllosoma* the larva of *Palinurus.*)

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(*Carcinus Mænas, Portunus plicatus, Cancer pagurus, Maia verrucosa, Inachus dorynchus, Pisa Gibbsii, Homarus vulgaris, Palinurus vulgaris, Galatea squamifera. Xantho floridus, X. rivulosus, Pilumnus hirtellus, Polybius Henslowii, Portunus puber*, and several others hatched as zoëæ.)

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(*Carcinus Mænas, Palinurus vulgaris, Homarus vulgaris, Crangon vulgaris, Palæmon serratus, Porcellana platycheles, Cyclops quadricornis, Orithyia coccinea, Nymphon gracile.*)

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On the Embryo State of *Palinurus vulgaris. Nat. Hist. Rev.*, IV., Proc. Soc., pp. 250–257, Pl. XVII. *1857. Rep. Brit. Assoc. Adv. Sci. for* 1857, Trans. of Sect., pp. 102, 103. *1858.*

(Larva referred to *Phyllosoma* by Gerstaecker, *Arch. f. Naturgesch. 1858*, 2, p. 455.)

Cunningham, Robert O.

[Letter to C. Spence Bate,] Carcinological Gleanings, No. III., *Ann. Mag. Nat. Hist.* [4], I. pp. 442–446. *1868.*

(*Uca Cunninghami* Bate with live, fully developed young ones under the pleon.)

Czerniavsky. *See* **Tscherniawsky.**

Dana, James D.

United States Exploring Expedition, during the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U. S. N. Vol. XIII. Crustacea. Philadelphia, *1852.* xii. + 1618 pp., 96 pl.

(*Passim.*)

Danielssen [D. C.]. *See* **Koren, J.**

Darwin, Charles.

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(Metamorphoses, pp. 8–28.)

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(Metamorphoses, pp. 102–133.)

De Filippi. *See* **Filippi.**

De Geer. *See* **Geer.**

De La Valette St. George. *See* **La Valette St. George.**

Dohrn, Anton.

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(Observations on development in *Nachtrag.*)

Untersuchungen über Bau und Entwicklung der Arthropoden. 6. Zur Entwicklungsgeschichte der Panzerkrebse (*Decapoda Loricata*). *Zeitschr. f. wissensch. Zool.*, XX. pp. 249–271, Taf. XVI. *1870.*

(*Scyllarus arctus, Palinurus vulgaris.*)

Untersuchungen über Bau und Entwicklung der Arthropoden. 7. Zur Kenntniss vom Bau und der Entwicklung von *Tanais*. *Jenaische Zeitschr.*, V. pp. 293–306, Taf. XI., XII. *1870.*

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Untersuchungen über Bau und Entwicklung der Arthropoden. 9. Eine neue Nauplius-Form (*Archizoëa gigas*). *Zeitschr. f. wissensch. Zool.*, XX. pp. 597–606, Taf. XXVIII., XXIX. *1870.*

(*Cirripedia.*)

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(*Amphion, Lophogaster, Portunus, Pandalus, Galatea, Elaphocaris.*)

Untersuchungen über Bau und Entwicklung der Arthropoden. 11. Zweiter Beitrag zur Kenntniss der Malacostraken und ihrer Larven-formen. *Zeitschr. f. wissensch. Zool.*, XXI. pp. 356–379, Taf. XXVII.–XXX. *1871.*

(Zoëæ, pp. 372–378, Taf. XXIX., XXX.)

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(Contains remarks on development of various Crustacea, *passim.*)

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(*Palæmon*, *Crangon.*)

On the Metamorphoses of the Crustacea. *Ann. Nat. Hist.*, III. pp. 438–440, Pl. XI. *1839.*

(*Carcinus Mænas.*)

Dujardin, Félix.

Observations sur les Métamorphoses de la *Porcellana longicornis*, et Description de la Zoé, qui est la Larve de ce Crustacé. *Comptes Rendus de l'Acad. des Sci., Paris*, XVI. pp. 1204–1207. *1843.*

Duthiers. *See* **Lacaze-Duthiers.**

Edwards. *See* **Milne Edwards.**

Erdl, M. P.

Entwicklung des Hummereies von den ersten Veränderungen im Dotter an bis zur Reife des Embryo. München, *1843.* 40 pp., 4 pl.

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(Plate II. figs. 1–10, *Carcinus Mænas in ovo.*)

Eschscholtz, Fr.

Bericht über die zoologische Ausbeute während der Reise von Kronstadt bis St. Peter-und-Paul. *Isis*, *1825*, 1, col. 733–747, Taf. V.

(*Lonchophorus anceps*, col. 734, Taf. V. fig. 1, described as a Macrouran, is a Brachyuran zoëa, described by A. Dohrn, *Zeitschr. f. wissensch. Zool.*, XXI. p. 373, Taf. XXX. fig. 52, *1871*, and by Claus, under the name of *Pluteocaris*, "Untersuchungen," &c., p. 65, Taf. XII. figs. 1–7, *1876.*)

Faxon, Walter.

On some Young Stages in the Development of *Hippa*, *Porcellana*, and *Pinnixa*. *Bull. Mus. Comp. Zoöl. at Harvard Coll., in Cambridge*, V. pp. 253–268, 5 pl. June 30, *1879.*

(Includes notice of unpublished observations of S. I. Smith on development of *Pinnixa*, pp. 264, 265, and *Pinnotheres*, p. 265, *foot-note.*)

On the Development of *Palæmonetes vulgaris.* *Bull. Mus. Comp. Zoöl. at Harvard Coll., in Cambridge,* V. pp. 303–330, 4 pl. Sept. *1879.*

(Includes notice of schizopod stage of *Virbius zostericola*, p. 322.)

On some Points in the Structure of the Embryonic Zoëa. *Bull. Mus. Comp. Zoöl. at Harvard Coll., in Cambridge,* VI. pp. 159–166, 2 pl. Oct. 19, *1880.*

(*Carcinus Mænas, Panopeus Sayi, Gelasimus pugnax.*)

Filippi, F. de.

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(Development, pp. 200–203, Tav. XII., XIII. figs. 10, 11.)

*Ueber die Entwicklung von *Dichelaspis Darwinii.* *Moleschott's Untersuchungen zur Naturlehre des Menschen und der Thiere,* IX. pp. 113–120, 2 pl. *1863.*

Fischer, Sebastian.

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Also printed separately, with date *1851.*

(Young individuals of several species represented.)

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(Young *Cypris*, pp. 643, 644, Taf. XIX. figs. 7, 8.)

Fraisse, Paul.

Die Gattung *Cryptoniscus* Fr. Müller (*Liriope* Rathke). *Arbeit. aus dem zoolog.-zootom. Inst. in Würzburg,* IV. pp. 239–296, Taf. XII.–XV. *1878.*

(Includes development. Nauplius of *Peltogaster Rodriguezii*, Taf. XV. fig. 57.)

Entoniscus Cavolinii n. Sp., nebst Bemerkungen über die Umwandlung und Systematik der Bopyriden. *Arbeit. aus dem zoolog.-zootom. Inst. in Würzburg,* IV. pp. 382–440, Taf. XX., XXI. *1878.*

Frey (Heinrich) and Leuckart (Rudolph).

Beiträge zur Kenntniss wirbelloser Thiere mit besonderer Berücksichtigung der Fauna des Norddeutschen Meeres. Braunschweig, *1847.* 170 pp., 2 pl.

(Development of *Mysis*, pp. 127–130.)

Frič. *See* **Fritsch.**

Fritsch, Anton.

Ueber das Vorkommen von *Apus* und *Branchipus* in Böhmen. *Verhandl. d. Kais.-Königl. zoolog.-botan. Gesell. in Wien,* XVI. pp. 557–562. *1866.*

(On the influence of desiccation on the development of the egg, &c.)

Gamroth, Alois.

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(Development, pp. 122, 123, Taf. VIII. figs. 15-21.)

Geer, Charles De.

Mémoires pour servir à l'Histoire des Insectes. Tome VII. Stockholm, *1778.* 7e Mém. Des Monocles, pp. 443-491, Pl. XXVII.-XXX.

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(Larvæ of *Cladocera*, *Copepoda*, *passim.*)

Geoffroy Saint-Hilaire, Isid.

Rapport fait à l'Académie royale des Sciences, sur un Mémoire de M. Milne Edwards, intitulé : Observations sur les Changements de Forme que les Crustacés eprouvent dans le jeune Âge. *Ann. Sci. Nat.* [1], XXX. pp. 360-372. *1833.*

Gerbe, J.

Sur les *Sacculina.* Extrait d'une Lettre de M. J. Gerbe, adressée à M. Van Beneden. *Bull. Acad. Roy. Belgique,* [2], XIII. pp. 339, 340. *1862.*

(On development.)

Recherches sur la Constitution et le Développement de l'Œuf ovarien des Sacculines. *Comptes Rendus de l'Acad. des Sci., Paris,* LXVIII. pp. 460-462, 22 Feb. *1869.*

Abstr. in *Rev. Mag. Zool.* [2], XXI. pp. 79, 80. *1869.* *Ann. Mag. Nat. Hist.* [4], III. pp. 321, 322. *1869.*

Réponse aux Observations de M. Balbiani, sur le Rôle des deux Vésicules que renferme l'Œuf primitif. *Comptes Rendus de l'Acad. des Sci., Paris,* LXVIII. pp. 670, 671. Mar. 15, *1879.*

(Egg of *Sacculina.*)

Gerbe, Z.

Métamorphoses des Crustacés marins. *Comptes Rendus de l'Acad. des Sci., Paris,* LIX. pp. 1101-1103. *1864.* *Rev. Mag. Zool.* [2], XVII. pp. 79-83. *1865.* *Ann. Mag. Nat. Hist.* [3], XV. pp. 237, 238. *1865.*

Notice by C. Spence Bate in *Rec. Zoölog. Lit.* (1865), II. pp. 321, 322. *1866.*

(*Phyllosoma* the young of *Palinurus.* Embryonic skin with invaginated spines in numerous genera.)

Métamorphoses des Crustacés marins. Deuxième Note. *Comptes Rendus de l'Acad. des Sci., Paris,* LX. pp. 74-77. *1865.* *Rev. Mag. Zool.* [2], XVII. pp. 83-87. *1865.* *Ann. Mag. Nat. Hist.* [3], XV. pp. 356-358. *1865.*

(Internal structure of *Phyllosoma* and other larvæ.)

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Trans. by W. S. DALLAS in *Ann. Mag. Nat. Hist.* [3], XVIII. pp. 7–12. *1866.*

(*Porcellana*, *Homarus*, *Phyllosoma*, *Nymphon*, &c.)

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(Conclusions from observations recorded in three preceding notes.)

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(Larva of *Palinurus*, described by R. Q. COUCH (*Nat. Hist. Rev.* IV., *Rep. Brit. Assoc. Adv. Sci. for* 1857), referred to *Phyllosoma.*)

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(Development, *passim.*)

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(An immature form. See AD. TARGIONI TOZZETTI, *Bull. Soc. Entomol. Italiana,* IV. pp. 84–96, Tav. I. *1872.*)

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(Nauplius of *Ophioseides apoda*, Pl. XIX. fig. 2.)

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("Nauplius-eye" in embryo.)

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(Development, pp. 693–698. On the eye of *Cypris*-larva of *Cirripedia*, p. 695, *foot-note.*)

On the Nauplius and Pupa Stage of *Suctoria. Ann. Mag. Nat. Hist.* [5], II. pp. 233, 234. Sept. *1878.*

(Fritz Müller's "*Peneus*-nauplius" *not* a larval Suctorian.)

Gissler, Charles F.

Contributions to the Fauna of the New York Croton Water. Microscopical Observations during the Years 1870–71. New York, *1872*. 23 pp., 5 pl.

(Young of *Cyclops* and *Cypris*.)

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(Young of *Hyperia* [?], p. 368, Pl. XXII. fig. 15.)

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(Development of *Balanus*, pp. 115–118, Pl. III., IV. Last zoëa stage and first megalopa stage of *Galatea* [*Porcellana?*], pp. 169–172, Pl. VII., VIII.; also brief notice in *A Year at the Shore*, p. 194, London, *1865*.)

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(Also contains observations on larva of *Cyclops* and *Ergasilus*.)

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(Observations on development, *passim.*)

Guérin-Méneville, Felix Eduard.

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(Young of several *Decapoda.*)

Hartmann, Robert.

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(Development, p. 749, Taf. XVIII. figs. 21–28.)

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(Nauplii, *passim.*)

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(Parasitic *Copepoda.*)

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(See later paper in *Revue des Sci. Nat.*)

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(Development of *Athelgue*, pp. 100–102, Pl. VIII. figs. 2^h–2^k.)

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(Few observations on development.)

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(*Praniza*, *Anceus*, and parasitic *Copepoda.*)

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(Embryos of some species parasitic in Ascidians.)

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(Includes observations on development.)

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(Young of *Notopterophorus bombyx*, pp. 225, 226; *Pleurocrypta Galatea*, pp. 233–235, Pl. IV. figs. 18–28.)

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(Young of several species found parasitic in compound Ascidians.)

Observations sur des Crustacés rares ou nouveaux des Côtes de France. 7e Art. Mémoire sur un nouveau Crustacé parasite appartenant à l'Ordre des Lernéidiens, formant la Famille des Lernéosiphoniens et le Genre Leposphile. *Ann. Sci. Nat.* [5], Zool., V. pp. 265–279, Pl. IX. *1866.*

Trans. by W. S. Dallas in *Ann. Mag. Nat. Hist.* [3], XVIII. pp. 73–82. *1866.*

(Larva, pp. 269, 270, figs. 23–26.)

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(Young of *Doropygus*, a parasite of Ascidians, pp. 57, 65.)

Observations sur des Crustacés rares ou nouveaux des Côtes de France. 10e Art. Peltogastres et Sacculinidiens. *Ann. Sci. Nat.* [5], Zool., VI. pp. 321–360, Pl. XI., XII. *1866.*

(Includes observations on development.)

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(Includes observations on larvæ of *Cirripedia.*)

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(Young, pp. 108, 109, figs. 4, 5.)

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(Embryo of *Cuma terginigra*, pp. 353, 354, fig. 19.)

Observations sur des Crustacés rares ou nouveaux des Côtes de France. 17ᵉ Art. Description d'un nouveau Crustacé Type d'une nouvelle Famille des Annelidicoles; du Genre des Chelonidiformis; du nouveau Genre Aplopode et de plusieurs autres Crustacés, encore inédits, appartenant aux Genres Polychliniophile, Cryptopode, Botryllophile, Bothacus, Adranesius, Lygephile et Doropygus. *Ann. Sci. Nat.* [5], Zool., XI. pp. 275–308. *1869.*

(Observations on young, *passim.*)

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(Embryology, pp. 7–15, Pl. I.)

Mémoire sur des Crustacés rares ou nouveaux des Côtes de France. 21ᵉ [20ᵉ] Art. Mémoire sur la Famille des Sphéromiens, à l'Occasion des Affinités et des Relations sexuelles qui paraissent exister entre les Sphéromiens et les Cymodocéens d'une part, et les Dynaméniens et les Néséens d'autre part. *Ann. Sci. Nat.* [5], Zool., XVII., Art. 1. 35 pp., Pl. I.–III. *1873.*

(Treats of young, *passim.*)

Mémoire sur des Crustacés rares ou nouveaux des Côtes de France. 21ᵉ Art. Description de Crustacés nouveaux appartenant à la Légion des Edriophthalmes, de l'Ordre des Amphipodes, de la Famille des Piscicoles, de la Tribu des Enoplopodes, Nobis, du Genre des Ichthyomyzoques, Nobis. *Ann. Sci. Nat.* [5], Zool., XVII., Art. 7. 16 pp., Pl. IV. *1873.*

(Young of *Ichthyomyzocus Lophii* resembles adult, p. 11.)

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(Remarks on the young.)

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Description des Crustacés rares ou nouveaux des Côtes de France. 25e Art. Description du *Pagurus misanthropus;* son Ontogénie, sa Physiologie et sa Biologie. — Description d'un Larve trouvée mêlée à celles de ce Crustacé. — Observations concernant les *Pagurus Ulidianus* et *Prideauxii.* *Ann. Sci. Nat.* [6], Zool., III., Art. 5. 42 pp. Pl. V., VI. *1876.*

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(Includes young or *Praniza* state.)

Remarques sur le Genre Chalime. *Ann. Sci. Nat.* [6], Zool., V., Art. 10. 3 pp. *1877.*

(This so-called genus is a larva.)

Description des Mâles, non encore connus, des Lernanthropes de Gisler et de Kroyer, ainsi que de la Femelle d'une Espèce nouvelle, dessinés et peints d'après des Individus vivants. 30 pp., 3 pl. Ex. de la *Revue des Sci. Nat.,* VI., déc., *1877;* VII., juin, *1878.*

Description des Crustacés rares ou nouveaux des Côtes de France décrits et peints sur des Individus vivants. 29e Art. Description de dix nouveaux Crustacés, dont sept appartiennent du Genre *Cycnus* de Kroyer et trois au Genre *Kroyeria* de Van Beneden, tous décrits et dessinés sur des Individus vivants. *Ann. Sci. Nat.* [6], Zool., VIII., Art. 11. 34 pp., Pl. XIX.–XXI. *1879.*

(Larva of *Kroyeria,* a parasitic Copepod, Pl. XXI. fig. 10.)

Description des Crustacés rares ou nouveaux des Côtes de France décrits sur des Individus vivants. 30e Art. Description d'un nouveau Crustacé parasite appartenant à la Sous-Classe des Crustacés suceurs, de l'Ordre des Lernéides, formant la nouvelle Famille des Lernéopalmiens et le nouveau Genre des *Stylophores,* décrits et dessiné d'après des Individus vivants. *Ann. Sci. Nat.* [6], Zool., VIII., Art. 15. 16 pp., Pl. XXVIII. *1879.*

(Young of *Stylophorus hippocephalus,* p. 6, figs. 22-25.)

Hoek, P. P. C.

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Hosius, A.

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(Young, pp. 243 *et seq.*, figs. 23, 24.)

Huxley, Thomas H.

Lectures on General Natural History. Lecture XI. *The Medical Times and Gazette,* new ser., XIV. pp. 638, 639, fig. 1. June 27, *1857.*

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(Development of *Mysis.*)

On the Agamic Reproduction and Morphology of *Aphis,* Pt. II. § 2. Embryogeny of *Mysis,* as exemplifying the *Crustacea.* § 3. Embryogeny of *Scorpio,* as exemplifying the *Arachnida.* § 4. Generalizations regarding the Embryogeny of the *Articulata,* and Morphological Laws based on them. § 5. The Embryogeny of *Articulata, Mollusca,* and *Vertebrata* compared. *Trans. Linn. Soc. London,* XXII., Pt. III. pp. 225–234. *1858.*

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(Development, pp. 39–44, 205–226, figs. 8, 57–60.)

Joly, N.

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(Development, pp. 257–262, Pl. VII.)

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Recherches Zoologiques, Anatomiques et Physiologiques sur l'*Isaura cycladoïdes,* nouveau Genre de Crustacé à Test bivalve, découvert aux Environs de Toulouse. *Ann. Sci. Nat.* [2], Zool., XVII. pp. 293–349, Pl. VII.–IX. A. *1842.*

(*Estheria.* Development, pp. 321–330, Pl. IX. A.)

Sur les Métamorphoses d'un Crustacé de la Tribu des Salicoques, trouvé dans le Canal du Midi. *Comptes Rendus de l'Acad. des Sci., Paris*, XV. pp. 36, 37. *1842.*

(*Caridina Desmarestii.*)

Études sur les Mœurs, la Développement et les Métamorphoses d'une petite Salicoque d'Eau douce (*Caridina Desmarestii*), suivies de quelques Réflexions sur les Métamorphoses des Crustacés Décapodes en général. *Ann. Sci. Nat.* [2], XIX. pp. 34–86, Pl. III., IV. *1843.*

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Jurine, Louis.

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(Development, pp. 452–456.)

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(Young of *Copepoda*, *Cladocera*, *Ostracoda*, *passim.*)

Translation of the Memoir of Shäffer, Sur les Monocles à queue, ou Puces d'Eau rameuses, pp. 181–197.

(Development, pp. 196, 197.)

Mémoire sur le Chirocéphale. Par Bénédict Prevost, pp. 201–244, Pl. XX.–XXII.

(Development, pp. 214–220.)

Kellicott, D. S.

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("*Cancer rhomboidalis,*" p. 65, Tab. VI. fig. 1, is a megalopa. Observed the young of "*Cancer Phasma*" [*Caprella*] crawl from abdominal pouch of parent, "all perfectly formed," p. 67.)

Müller, Fritz.

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(Egg and young figured. *Ostracoda.*)

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(*Trichodactylus* leaves the egg in the perfect form, p. 152.)

See also **Bate, C. Spence.**

Müller, Otho Fredericus.

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Müller, P. E.

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(Larvæ of *Lernanthropus Kröyeri*, Pl. VII. figs. 7, 8.)

Olivier [Ant. Gu.].

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(Observations on young *Gammarus*, p. 183.)

Packard, A. S., Jr.

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Suhm. *See* **Willemoes-Suhm.**

Targioni Tozzetti, Ad.

Di una Specie nuova in un nuovo Genere di Cirripedi Lepadidei ospitante sulle Penne abdominali del *Priofinus cinereus* dell' Atlantico Australe e dell' Oceano Indiano raccolta nel Viaggio intorno al Mondo della Fregata Italiana *La Magenta* dai Professori F. De Filippi ed E. Giglioli. *Bull. Soc. Entomolog. Italiana*, IV. pp. 84–96, Tav. I. figs. 2–13. *1872.*

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(*Balanus.*)

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[Letter to Pennant, dated "Scarborough, 25th Oct. 1768."] PENNANT's *British Zoölogy,* IV. pp. 11–15. London, *1777.*

(Describes the eggs of *Homarus.* Young have "the appearance of tadpoles.")

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(Larva of *Balanus,* and three zoëæ.)

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Valette St. George. *See* **La Valette St. George.**

Van Beneden, Édouard.

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(Crustacea, pp. 107–143, Pl. VII.–X.)

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(Parasitic *Copepoda*, *Lernæans.*)

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(Larvæ, figs. 5, 6.)

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(Development of *Homarus*, pp. 263, 264.)

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(*Enterocola fulgens* P. J. Van Ben. Larva, figs. 6, 7.)

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See Rev. by Fritz Müller, *Ueber Cumaceen.* *Arch. f. Naturgesch.*, *1865*, 1, pp. 311–323.

(Development of *Mysis*, pp. 52–69, Pl. VI. figs. 9–12, VIII.–XI.; *Homarus*, p. 53; *Cuma*, pp. 75, 87; *Cyamus*, p. 95; *Anceus*, p. 102, Pl. XVI.; *Peltogaster*, p. 118, Pl. XXI. figs. 5–7; *Sacculina*, Pl. XX. figs. 8, 9, Pl. XXI. figs. 8, 9; *Lernæa*, p. 131, Pl. XIX. figs. 9–13.)

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(Development, pp. 34–43, Taf. III., IV.)

Vogt, Carl.

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1er Mém. De la Famille des Philichthydes et en particulier du Léposphile des Labres (*Leposphilus labrei* Hesse). Pp. 1–41, Pl. I., II.

(Nauplius, p. 26, Pl. I. fig. 10.)

2d Mém. Sur quelques Copépodes Parasites à Males Pygmées habitant les Poissons. Pp. 43–104, Pl. III.–VI.

(Nauplius of *Brachiella*, p. 56, Pl. III. fig. 8; *Chondracanthus*, pp. 86–88, Pl. V.)

Also in *Arch. Zool. Expér.*, VI. 385–456. *1877.*

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1er Mém. Leposphile des Labres, Famille des Philichthydes.

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(Nauplius of *Leposphilus*, *Brachiella*, *Chondracanthus.*)

Same as the preceding.

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*In *Arbeit. d. ersten Sitzung Russischer Naturforscher in St. Petersburg, 1868*, pp. 218–237, Taf. I.–IV.

(Development of *Hyalosoma* [*Leptodora*], according to Gerstaecker, *Arch. f. Naturgesch.*, *1871*, 1, p. 351.)

Wagner, Rudolphus.

Prodromus Historiæ Generationis Hominis atque Animalium. Lipsiæ, *1836.* 15 pp., 2 pl.

(Eggs of *Porcellio*, *Cypris*, *Balanus*, *Gammarus*, *Astacus*, *Carcinus*, p. 8, Pl. I. figs. 12–17.)

Weismann, August.

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II. Die Eibildung bei den Daphnoiden. Pp. 95–175.

III. Die Abhängigkeit der Embryonal-Entwicklung vom Fruchtwasser der Mutter. Pp. 176–211.

IV. Ueber den Einfluss der Begattung auf die Erzeugung von Wintereiern. Pp. 212–240.

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Ueber das Ansetzen der Cirripedien an eisernen Schiffen. *Verhandl. d. Vereins f. naturwissensch. Unterhalt. zu Hamburg*, III. (1876), pp. 31, 32. *1878.*

Westwood, J. O.

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On the Transformations of the Crustacea. *Rep. Brit. Assoc. Adv. Sci. for 1834*, pp. 608, 609. *1835.*

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(*Gecarcinus*, with direct development.)

See also **Bate (C. Spence)** and **Hailstone (S.)**.

Willemoes-Suhm, Rudolf von.

On a new Genus of Amphipod Crustaceans. *Proc. Roy. Soc. London*, XXI. pp. 206–208. *1873. Ann. Mag. Nat. Hist.* [4], XI. pp. 389–391. *1873.*

(*Thaumops pellucida* W.-S. [*Cystisoma Neptuni* Guér.-Mén.] undergoes no metamorphosis after leaving the egg. pp. 207, 208.)

Von der Challenger-Expedition. Briefe an C. Th. E. v. Siebold von R. v. Willemoes-Suhm. I. *Zeitschr. f. wissensch. Zool.*, XXIII. pp. i.–vii. May, *1873.*

(Embryo of *Thaumops pellucida* W.-S. [*Cystisoma Neptuni* Guér.-Mén., Amphipod] undergoes no metamorphosis. p. vi.)

Von der Challenger-Expedition. Briefe an C. Th. E. v. Siebold von R. v. Willemoes-Suhm. II. *Zeitschr. f. wissensch. Zool.*, XXIV. pp. ix.–xxiii. Oct. *1874.*

(Young *Isopoda* and *Amphipoda* of Antarctic Islands developed in sacs of parent. Larval stages of the higher Crustacea not found on the surface at Kerguelen's Isl., excepting one small zoëa.)

Von der Challenger-Expedition. Briefe von R. v. Willemoes-Suhm an C. Th. E. v. Siebold. V. *Zeitschr. f. wissensch. Zool.*, XXVI. pp. lix.–lxxv. Dec. *1875.*

(According to a very intelligent fisherman, Menancio Perez, the young *Birgus* on hatching is like the parent in form, p. lxxiii.)

On some Atlantic Crustacea from the "Challenger" Expedition. V. On the Development of a Land Crab. *Trans. Linn. Soc. London* [2], Zool., I. pp. 46–48, Pl. XI. figs. 1–3. *1875.*

(Zoëa of *Cardisoma* from Cape-Verd Isl. Direct development of *Telphusa fluviatilis* from Italy.)

On the Development of *Lepas fascicularis* and the "Archizoëa" of *Cirripedia. Phil. Trans. Roy. Soc. London,* CLXVI. pp. 131–154, Pl. X.–XV. *1876.*

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(*Amphion, Sergestes, Lucifer.*)

Preliminary Report to Professor Wyville Thomson, F. R. S., Director of the Civilian Scientific Staff, on Observations made during the earlier Part of the Voyage of H. M. S. "Challenger." *Proc. Roy. Soc. London,* XXIV. pp. 569–585. *1876.*

(Blind megalopa from 1675 fms., p. 577; *Cardisoma* zoëa, p. 582.)

Von der Challenger-Expedition. Briefe von R. v. Willemoes-Suhm an C. Th. E. v. Siebold. VII. *Zeitschr. f. wissensch. Zool.*, XXVII. pp. xcvii.–cviii. May, *1876.*

(*Sergestes, Lucifer, Lepas,* pp. cvi.–cviii. Same observations as those recorded in *Preliminary Remarks, &c.*, and *On the Development of* Lepas fascicularis, *&c.*)

Wilson, E. B. *See* **Brooks, W. K.**

Wilson, H. S. *See* **Turner, Wm.**

Woodward, Henry.

Art. *Crustacea* in *Encyclopædia Britannica* (9th ed.), VI. pp. 632–666. *1877.*

(General account of development, pp. 643–652. Australian *Dromia*, with direct development, p. 644.)

Zaddach, Ernestus Gustavus.

De Apodis cancriformis Schaeff. Anatome et Historia Evolutionis. Bonnæ, *1841.* 72 pp., 4 pl.

(Development, pp. 55–64, Pl. IV.)

Zenker, Jonathan Carolus.

De Gammari pulicis Fabr. Historia Naturali atque Sanguinis Circuitu Commentatio. Jenæ, *1832*. viii. + 28 pp., 1 pl.

(Remarks on development, p. 17.)

Zenker [Wilhelm].

Monographie der Ostracoden. *Arch. f. Naturgesch. 1854*, 1, pp. 1–87, Taf. I.–VI. figs. 1, 2.

(Development, pp. 57–60.)

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[Notice of *Phyllosoma* hatched from Eggs of *Palinurus vulgaris* at Brighton Aquarium.] *Nature*, VIII. p. 231. *1873*. *Amer. Journ. Sci. & Arts* [3], VI. p. 229. *1873*.

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Claus, Carl.

Untersuchungen über die Organisation und Verwandtshaft der Copepoden. (In Auszuge zusammengestellt.) *Würzburg. naturwiss. Zeitschr.*, III. pp. 51–103. *1862*.

(Development, pp. 78–82.)

Dohrn, Anton.

*Studien zur Embryologie der Arthropoden. *1868*. (Habilitationsschrift.)

Hartog, Marcus.

On the Anal Respiration of the *Copepoda*. *Quart. Journ. Microscop. Sci.* [2], XX. pp. 244, 245. April, *1880*. *Journ. Roy. Microscop. Soc.*, III. Pt. 2, pp. 632, 632. *1880*.

(Anal respiration in nauplius of *Cyclops* and *Diaptomus*, p. 245.

On the Respiration of the Crustacea. *Quart. Journ. Microscop. Sci.* [2], XX. p. 485. Oct. *1880*. *Journ. Roy. Microscop. Soc.*, III. Pt. 2, p. 944. *1880*.

(Anal respiration in zoëæ.)

Kossmann, Robby.

Die Entonisciden. *Mittheil. aus der zoolog. Station zu Neapel*, III. pp. 149–169, Taf. VIII., IX. Dec. 9, *1881*

(Development, pp. 166–168, Taf. VIII., fig. 6.)

Studien über Bopyriden. III. *Jone thoracica* und *Cepon portuni*. *Mittheil. aus der zoolog. Station zu Neapel*, III. pp. 170–183, Taf. X., XI. Dec. 9, *1881*.

(Young stages described and figured.)

XIPHOSURA (Limulus).

Agassiz, Alexander.

Note on the Habits of young *Limulus*. *Amer. Journ. Sci. & Arts* [3], XV. pp. 75, 76. *1878*. *Ann. Mag. Nat. Hist.* [5], I. pp. 183, 184. *1878*.

(Swim, feed, and rest on their backs.)

Beneden. *See* **Van Beneden.**

Dohrn, Anton.

Untersuchungen über Bau und Entwickelung der Arthropoden. 12. Zur Embryologie und Morphologie des *Limulus Polyphemus*. *Jenaische Zeitschr.*, VI. pp. 580–640, Taf. XIV., XV. *1871*.

Edwards. *See* **Milne Edwards.**

Gegenbaur, C.

Anatomische Untersuchung eine *Limulus*, mit besonderer Berücksichtigung der Gewebe. *Abhandl. Naturforsch. Gesell. Halle*, IV. pp. 229–250, 1 pl. *1858*.

(Structure of egg, pp. 247–249, fig. 9.)

Lockwood, S.

The Horse-Foot Crab. *Amer. Naturalist*, IV. pp. 257–274, Pl. III. July, *1870*.

(Development of *Limulus Polyphemus*.)

Milne Edwards, Henri.

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(Young *Limulus* at time of hatching.)

Notice of, in VAN DER HOEVEN's *Recherches sur l'Histoire Naturelle et l'Anatomie des Limules*, p. 44. Leyde, *1838*.

Packard, A. S., Jr.

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(Notice of observations given in full in *Mem. Boston Soc. Nat. Hist.*, II. pp. 155–202. *1872*.)

Morphology and Ancestry of the King Crabs. *Amer. Naturalist*, IV. pp. 754–756. Feb. *1871*.

(Abstract of some of the conclusions stated in *Mem. Boston Soc. Nat. Hist.*, II. pp. 155–202. *1872*.)

The Development of *Limulus Polyphemus*. *Mem. Boston Soc. Nat. Hist.*, II. pp. 155–202, Pl. III.–V. March, *1872*.

Abstract by the author in *Life Histories of the Crustacea and Insects, Amer. Nat.*, IX. pp. 589–592, figs. 239–246, Nov. *1875*; *Life Histories of Animals including Man, or Outlines of Comparative Embryology*, New York, *1876*; and in *Zoölogy for Students and General Readers*, pp. 320–323, New York, *1879*.

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Farther Observations on the Embryology of *Limulus*, with Notes on its Affinities. *Amer. Naturalist*, VII. pp. 675–678. Nov. *1873*. *Proc. Amer Assoc. Adv. Sci.*, 22d Meeting (1873), Pt. II. pp. 30–32. *1874*.

On the Development of the Nervous System in *Limulus*. *Amer. Naturalist*, IX. pp. 422–424. July, *1875*.

The Anatomy, Histology, and Embryology of *Limulus Polyphemus*. *Annivers. Mem. Boston Soc. Nat. Hist.* *1880*. 45 pp., 7 pl.

(Embryology, pp. 36–40, Pl. I., III., IV.)

Suhm. *See* **Willemoes-Suhm.**

Van Beneden, Édouard.

De la Place que les Limules doivent occuper dans la Classification des Arthropodes d'après leur Développement embryonnaire. *Ann. Soc. Entomol. Belgique*, XV. *Comptes Rendus*, pp. x., xi. 14 Oct. *1871*. *Gervais's Journ. de Zoologie*, I. pp. 41–44. *1872*. *Ann. Mag. Nat. Hist.* [4], IX. pp. 98, 99. Jan. *1872*.

*[Observations on the first Stages of embryonic Development in *Limulus*.] *Tageblatt d. 46er Versamml. deutsch. Naturforsch. u. Aertze in Wiesbaden*, *1873*, p. 58.

Willemoes-Suhm, Rudolf von.

Von der Challenger-Expedition. Nachträge zu den Briefen an C. Th. E. v. Siebold von R. v. Willemoes-Suhm. VIII. *Zeitschr. f. wissensch. Zool.*, XXIX. pp. cix.–cxxxvi. June, *1877*.

(*Limulus* from the Philippine Islands has a free-swimming nauplius larva, p. cxxxii.)

Challenger-Briefe von Rudolf v. Willemoes-Suhm Dr. Phil. 1872–1875. Nach dem Tode des Verfassers herausgegeben von seiner Mutter. Leipzig, *1877*. 180 pp.

(*Limulus rotundicaudatus* does not have a direct development like *L. Polyphemus* but has a nauplius larva, pp. 157, 158. [Letter to Professor Kupffer.])

TRILOBITA.

Barrande, Joachim.

Systême Silurien du Centre de la Bohême. Prague et Paris.

Métamorphoses des Trilobites, I. pp. 257–278, Pl. VII., XLIX., &c. *1852.* I. Suppl., pp. 182–189, Pl. *passim. 1872.*

Cf. A. GERSTAECKER in BRONN'S *Klassen und Ordnungen des Thier-Reichs*, V. (Arthropoda), I. Abt., 1. Hälfte, pp. 1200–1208, Taf. XLIII., XLVI. Leipzig und Heidelberg, *1879.*

Ford, S. W.

On some Embryonic Forms of Trilobites from the Primordial Rocks at Troy, N. Y. *Amer. Journ. Sci. & Arts* [3], XIII. pp. 265–273, 1 pl. *1877.*

On additional Embryonic Forms of Trilobites from the Primordial Rocks of Troy, N. Y., with Observations on the Genera *Olenellus*, *Paradoxides*, and *Hydrocephalus*. *Amer. Journ. Sci.*, XXII. pp. 250–259, 13 cuts. *1881.*

Walcott, C. D.

Note upon the Eggs of the Trilobite. 31*st Ann. Rep. N. Y. State Mus. Nat. Hist.*, pp. 66, 67. Albany, *1879.* (Published and distributed in advance of Report, Sept. 20, *1877.*) *Bull. Mus. Comp. Zoöl., at Harvard Coll., in Cambridge*, VIII. p. 216, Pl. IV. figs. 8, 8*a*. *1881.*

Fossils of the Utica Slate. *Trans. Albany Inst.*, X. (Printed in advance, June, *1879.*)

Metamorphoses of *Triarthrus Becki*, pp. 24–33, Pl. II. figs. 1–15.

◆

PYCNOGONIDA.

Allman [George James].

On a Remarkable Form of Parasitism among the *Pycnogonidæ*. *Rep. Brit. Assoc. Adv. Sci. for* 1859, Trans. of Sect., p. 143. *1860.*

(Young *Ammothea?* parasitic in *Coryne.*)

Böhm, R.

Zwei neue, von Herrn Dr. Hilgendorf in Japan gesammelte Pycnogoniden. *Sitzungs-Ber. Gesell. naturforsch. Freunde zu Berlin, 1879*, pp. 53–60, 140–142.

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No. 7. — *Explorations of the Surface Fauna of the Gulf Stream, under the Auspices of the U. S. Coast Survey, by* ALEXANDER AGASSIZ.

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I.

Notes on Acalephs from the Tortugas, with a Description of New Genera and Species. By J. WALTER FEWKES.

THE following pages contain descriptions of new medusæ collected at Key West and the Tortugas Islands, in March and April, 1881.* They contain an account of the anatomy and development of *Linerges*, *Cassiopea* (*Polyclonia*), *Ocyroë*, and a stage in the embryology of *Eucharis*. Six new species of *Siphonophora*, two new genera and three new species of *Hydroida*, are also described. New larval stages of growth, illustrative of the development of *Glossocodon*, are also figured and described.

CTENOPHORA.

Beroë ovata, ESCH.

Plate IV. Fig. 1.

B. ovata is common along the Florida Keys. It has a quicker motion and is larger than *B. roseola*. The sense area is also more prominent.

Eucharis multicornis, ESCH.

Plate VII. Figs. 11, 12.

A larva of *Eucharis*, closely resembling the young of *E. multicornis*, was found at Key West. It is smaller than the adults of *E. multicornis*,† and is more transparent. It wants also the brown red color of the well-known Mediterranean species.

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* An account of A. Agassiz's explorations of the Tortugas, when these medusæ were found, is published in Harv. Univ. Bull., XIX. p. 218, and Bull. Mus. Comp. Zoöl., IX. 3. I am indebted to A. Agassiz for affording an opportunity to visit Key West and the Tortugas as his assistant.

† Chun, Die Ctenophoren der Golfes von Neapel, &c., p. 297.

Ocyroë crystallina, RANG.

Plate I. Figs. 1 – 6.

A larval stage of this medusa* was found at the Tortugas. The anatomy of this Ctenophore is very characteristic. It differs from *Deïopea kaloktenota*, Chun,† in size, in the absence of tentacles, and in the presence of very prominent longitudinal muscles (*l m*) on the under and inner surface of the oral lappets. It has only a remote likeness to the young of other genera. The motion of the animal is very characteristic, as it is caused, for the most part, not by the movement of the vibratile combs on the outer surface of the body, but by the strokes against the water of the oral lappets or lobes.

When the animal is resting, the oral lappets are widely extended at right angles to the axis of the body (fig. 2). As movement begins, these lobes are quickly raised from that position to one above the actinal pole, so that their outer surfaces approach and almost touch each other over it (fig. 4). Both lobes are then swung simultaneously downward, passing through an angle of 180°, and made to approach each other below the mouth, as in fig. 1. A flapping motion of this kind is continued without interruption several times and then ceases, the lappets returning to the position of rest with which they started. When the inertia acquired by this flapping is lost, the motion is again repeated.‡ Practically the "combs" contribute nothing to the motion of the medusa. This larva, like the adult *Ocyroë maculata*, has neither tentacles nor tentacular sacs. The single specimen found was without doubt immature, and we should expect to find a true tentacle hanging from its body walls. In the young *Bolina* the tentacles are very large, while in the adult they are reduced to simple club-shaped processes. In the *Ocyroë* larva there is no indication of the tentacle nor of the tentacular sac. The adult also has nothing which can be homologized to these structures.§

The body of the larva has a short axis, and resembles distantly that of a young *Bolina*. The oral lappets are large, widely extended when at rest, and crossed on their lower, inner surface by longitudinal muscles (fig. 5, *l m*).‖

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* It may be the young of *O. maculata*, *O. fusca*, or *O. crystallina*, as described by Rang (Établissement de la Famille des Beroides, *Ocyroë*, 1827).

† *Op. cit.*, p. 294, Pl. IV. figs. 1–4.

‡ A. Agassiz observed a similar motion of the oral lappets of *O. maculata*, Bull. Mus. Comp. Zoöl., VIII. 7.

§ This is true of the adult of *O. maculata*.

‖ The study of these muscles in the young *O. crystallina* leads me to believe that I was wrong in considering the "spots" on the lobes of *O. maculata* as muscular in character, an opinion expressed in a previous paper. (Bull. Mus. Comp. Zoöl., VIII. 7.) These spots in *O. maculata* are probably due to pigment in the walls of the lobes.

The same surface is covered by a network of muscular fibres, similar to that found on the inner walls of the oral lappets of *Bolina*, and other genera. Lips (*l*) simple, very flexible, and prominent, projecting below the mouth. The auricles (*a*) are stout and not very prominent. There are two swimming combs on each ambulacrum. The course of the chymiferous tubes does not differ from that of the vessels of *Bolina*. The lateral or subtentacular tube (*l t*) arises from the lower end of the funnel (*fn*), and passes down along the side of the body into one of the lips. At this point it bifurcates (*b*), sending a branch (*b′*) on each side to join the tube (*s t*), which arises from a short ambulacrum.* The vessel later formed by the union of these small tubes first skirts the margin of the auricle (*a*) and is then continued in the tube (*t*) around the rim of the oral lappets, joining half-way in its course a similar tube from the opposite side of the body. The branch from the lateral tube joins the auricular vessel just below the auricle.

The chymiferous vessels of the eight rows of swimming plates (*ambulacra*) primarily branch from the lower end of the "funnel" as two small tubes (fig. 6, *c*) on opposite sides of this medial vessel, in a vertical plane at right angles to that which passes through the longitudinal axis of the mouth (fig. 5). The plane in which they lie cuts at right angles the axis of the mouth and passes through the otocyst (fig. 5, *c*). Each of these primary branches bifurcates, at a short distance from its origin (*c*), and each smaller branch again subdivides (*c c*) into two members. In this way we have formed the eight vessels, which extend to the surface of the outer body walls, and form the meridional tubes, which lie directly under the rows of combs. The tubes (*s t*), which correspond to the "longer rows" of combs in the *Bolinidæ*, push their way into the oral lappets, and join in pairs, two in each lappet, while the shorter rows, after a more tortuous course, in which they unite with the bifurcations from the lateral tube (*l t*) and skirt the edge of the auricles, also eventually unite in the oral lobes, forming a loop, which encloses the union of the vessels (*s t*).† In the union of the "long tubes" adjacent vessels unite; in the junction of short tubes, vessels separated by a pair of long tubes join.

The otocyst resembles that of *Bolina*.

No liver glands or folds of the intestine and stomach were observed.

In Dr. Chun's ‡ figures of *Deïopea* the tubes corresponding with the vessels (*s t*) end blindly in the oral lappets without junction. In *Ocyroë* these tubes join as shown above. *Deïopea* has tentacular filaments extending from the position where the tentacle hangs to that of the auricles, along the lower edge of the body. Tentacular filaments are wanting in *O. crystallina*.

Dr. Chun,‡ as is well known, divides the *Ctenophora* into the two groups

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* The ambulacrum adjacent the tentacle on either side.

† These tubes are shorter than the others in the adult. They correspond with the "long tubes" in the young *Bolina*.

‡ *Op. cit.*, Pl. IV. figs. 2, 3.

Tentaculata and *Nuda*, accordingly as tentacles exist or are wanting. If this feature alone be used in classification, *Ocyroë* would be placed in the group of *Nuda* side by side with medusæ like *Beroë*, with which it has few other anatomical likenesses. If his classification be followed, *Ocyroë* must be regarded as a connecting form between *Ctenophora tentaculata* and *Ctenophora nuda.*

Ocyroë renders necessary some modification in the phylogenetic tree which Dr. Chun suggests, for the different genera of comb-bearing medusæ. The Beroids may have come from *Bolina* like jelly-fishes through *Ocyroë* rather than directly from other tentaculated Ctenophores. A. Agassiz has pointed out that this medusa has "structural characters of the *Lobatæ*, *Saccatæ*, and *Eurystoma*." * It is the intermediate form connecting *Beroë* with Ctenophores like *Mnemiopsis* or *Bolina.* Although most closely related to the *Lobatæ*, it resembles genera of the *Eurystomatæ* in the absence of tentacles and the course of the lateral tubes. The resemblance to the *Saccatæ* is more distant.

DISCOPHORA.

Cassiopea frondosa, LAMARCK.

Plate I. Figs. 7-19. Plate II. Figs. 1, 2. Plate III. Figs. 1-3, 9, 10.

Cassiopea frondosa † is very common in the moat outside Fort Jefferson on Garden Key (Tortugas Islands). Specimens were also found in the still waters and protected shallows in the lee of the Mangrove Keys, near Key West City.

Cassiopea frondosa is found lying on the coral mud at the sea bottom, with its bell reversed and the oral region turned uppermost (Pl. I. fig. 7.). When transferred to the aquarium it assumes a similar position, exhibiting little power of locomotion, but flapping the disk-shaped bell in a sluggish manner. This motion seems to be confined almost wholly to the margin of the bell. While it cannot be said to be fixed to the bottom in such a way that movement is impossible, it will be found, if its position from time to time be carefully observed, that it does move from place to place, although the amount is very small. It generally lies on its aboral region,‡ sluggishly flapping the bell margin in a monotonous manner, in general appearance, when seen from the boat floating above it, resembling a small cluster of nullipores. The habit of clinging to the bottom by the upper (aboral) surface of the bell is also found in a genus widely separated in our classification from *Cassiopea.* We noticed last summer a young *Cyanea* (*C. arctica*), which was kept in the aquarium at Newport, fasten itself in the same way, and adopt the same sluggish movement of the bell-margin which is so characteristic of *Cassiopea.* It is not impossible, although as yet not supported by observation, that the "aboral papillæ" (Bull. Mus. Comp. Zoöl., VIII. 8, p. 669, Pl. VII. fig. 1) of the young *Cyanea* may serve to anchor the young medusa in this posture.*

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* Bull. Mus. Comp. Zoöl., IX. 3.

† I regard this the same as *Polyclonia frondosa*, Agass. *Polyclonia* according to L. Agassiz has *twelve* marginal sense bodies and *twelve* radial markings. The specimens of *C. frondosa* studied by me had generally *sixteen* such structures. This is true of young as well as of adult *Cassiopeæ*, except in abnormal specimens.

C. frondosa is closely related to *C. Andromeda*, Esch.

‡ A similar posture has already been observed in *Cassiopea* by Mertens; in *Polyclonia*, by L. Agassiz; and in *Medusa æquorea*, Försk, by McAndrew. (Ann. Nat. Hist., IV., 1869, p. 295.)

The bell of *C. frondosa* is flat and disk-shaped, in larger specimens with a diameter of a foot or a foot and a half. When seen from the aboral pole (fig. 10), two regions can be distinguished on the surface. Of these the central part has a circular form, and a slightly concave surface. It is bounded by the circumference of a circle, whose diameter is about three fourths that of the whole disk, and whose circumference limits that rigid (fig. 7, *u*) portion of the medusa bell by which it is attached to the bottom.

The most marked feature in the structure of the central portion of the bell is the possession of sixteen radial stripes (*e*), which can best be seen from the aboral surface. These stripes are simple thickenings of the bell walls, and are most clearly defined near the periphery of the central region already described. At that point they assume a pyriform shape, while nearer the centre of the disk they become narrower until they disappear. A periphery drawn through the ends of these bodies, most distant from the middle of the bell, bounds the rigid portion of the umbrella and divides the central part from the flexible margin. The outline of the stomach cavity (*s*) can be easily made out through the aboral bell walls, in which, at this point, there are traces of the radial stripes. If the substance of the bell be cut in such a way as to make a cross section of a pyriform body, it will be found that it has a milky-white color, while adjoining parts of the bell are brown and green. Its tissue is also more compact than that of the rest of the bell. They seem to impart a greater rigidity to the bell walls, and not to be simply superficial coloration as sometimes supposed.

The marginal portion of the bell arches upward in the natural position of the medusa, and is very flexible. It is much thinner than the central part, and is almost wholly without radial markings.

The bell rim is destitute of tentacles. It has, however, marginal bodies which distantly represent these structures in tentaculated *Discophora.* These structures are of two kinds (*v l*, *o l*). They assume either the form of serrations (*v l*) placed peripherally (velar lappets), or take a crescentic shape (ocular lappets), (*o l*). In the latter case they are arranged in pairs and mark the position on the bell margin of the sense bodies. There are sixteen pairs of these structures (*o l*) having the more rounded shape, and each pair marks the position of an otocyst. They represent approximately those lappets which in the genus *Aurelia* project far beyond the bell margin.

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* In the genus *Cephea* we find structures homologous to the aboral papillæ assuming the form of small excrescences. Haeckel, *op. cit.*, p. 574, Pl. XXXVI. figs. 3, 5, 6.

Between each pair of crescent-shaped bodies there are three or four pointed serrations (*v l*) which represent in position the tentacles. The bell rim has a wavy crenate outline, slightly indented between the marginal serrations, and deeply incised between the crescentic bodies which have been mentioned above. The otocysts are found in the angle of these deeper incisions.

The anatomy of the oral region (fig. 11) of *Cassiopea* is in certain respects peculiar. When the jelly-fish is seen from this side, which is uppermost in the natural position of the medusa, a confused mass of bodies of all sizes covers it and conceals completely the bell itself. These bodies give to the *Cassiopea*, when seen from a distance, a remote likeness to a marine alga. If, however, the innumerable bodies which cover the oral pole of the medusa be pushed apart (fig. 11) so that their attachment can be seen, it will be found that they arise from branches which primarily originate from eight gelatinous arms (oral arms, *d*), which are themselves prolongations from a centrally placed projection ("Mundscheibe," *i*) from the oral surface of the bell.

In the middle of the lower floor of *Cassiopea* there rises a cylindrical body, Mundscheibe (*i*), of gelatinous consistency, which gives origin to the eight oral arms (*d*) of the stomach. It is an octagonal body, and is without opening on the upper surface. There is no single central mouth in *Cassiopea*, and no centrally placed orifice * into the cavity of this cylinder. The only external openings which are to be found are four orifices (*o*) on the sides of the body of the Mundscheibe, 90° apart. These openings lie in the intervals between the four pairs of branching oral tentacles, and are the sexual orifices. They communicate directly between the cavity of the ovaries which lie in that of the oral cylinder (Pl. III. fig. 3, *s o*) and the surrounding water.

Eight oral arms (*d*) are found branching in pairs from the sides of the oral cylinder, Mundscheibe (*i*). These appendages form the most important structures in the oral region of the *Cassiopea*, and bear organs which, as is probably the case in all *Rhizostomatæ*, represent the mouths of other genera of *Discophora*. Each oral arm extends at right angles to the sides of the oral cylinder, and parallel to the lower surface of the bell. It is irregularly branched (Pl. I. figs. 17, 19), and has solid walls of a gelatinous character. The outer surfaces (fig. 17) turned to the bell and the sides are smooth, while the upper surface (fig. 19) is covered with innumerable flask-shaped structures of different shapes and sizes. A system of vessels (*g v*) runs along the upper part of the oral tentacle just below the surface, communicating with the flask-shaped bodies and a centrally placed chymiferous cavity. There are two kinds of appendages found on the upper surface of the oral tentacles. Indiscriminately over the whole surface, and at the angle of bifurcation of smaller branches from the oral arms, we find ovoid bodies, "Kolbenförmige Blasen" (*p*), which, when extended, assume a flask-like form. The structures have walls of a greenish color with darker interiors, and communicate with the chymiferous tubes of the oral tentacles. They have no opening at their unattached end, and are simply closed sacs for the reception of fluid. The function of these bodies is unknown.

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* L. Agassiz, *op. cit.*, p. 147, mentions a central mouth opening in a young *Polyclonia*.

A second* kind of polyp-like bodies (p') is scattered over the upper surface of the oral tentacles. These are more numerous and smaller than the first. They are the true mouths of the *Cassiopea.* They resemble frills, between which there are slits surrounded by a circlet or row of minute tentacles. It is in fact as if we had the whole upper surface of the oral tentacle covered with small fresh-water hydræ, with mouth-openings very much elongated laterally, and around which the circumoral tentacles are very numerous. The central opening, or mouth, may be a circular orifice or an elongated slit. Whatever its form may be, the circlet of tentacles about it is always arranged in a single series. These sacs or sucking mouths communicate with the same system of vessels ($g\,v$) as the flask-shaped bodies (p) mentioned above. They are the mouths of the jelly-fish.

Within the Mundscheibe, or oral cylinder, there is a thin disk-shaped cavity (Pl. III. fig. 3), which may be called the stomach. Its floor is formed by the upper surface of the bell, and its roof by the upper wall of the Mundscheibe. The most prominent structures in the stomach are the four sexual organs, or, more accurately speaking, the four sexual sacs, since the sexual organs themselves (o) are separated from the stomach by a thin gelatinous wall. The ova cannot pass into the stomach, but are dropped in these sacs, and from them into the water through the four openings ($s\,o$) on the side of the oral disk. It will be noticed then that the ovarian openings do not lead into the chymiferous cavity, but into four sexual sacs which lie in the stomach. Morphologically, as has been suggested, the sexual sacs are invaginations of the outer surface of the Mundscheibe at the point where the sexual openings ($s\,o$) lie, and their cavities are wholly independent of that of the stomach. There are four sexual glands hanging to the walls of the sexual sacs, which are fastened to the oral disk or roof of the stomach on a V-shaped line, each gland filling a quadrant of the circle in which it is found. On the roof of the stomach between the lines of attachment of the sexual sacs, four grooves (g) are left, which cross each other at the centre at right angles. These grooves are simply spaces left between the lines of attachment of the sexual sacs. Near its peripheral end each groove deepens, and at the extremity sinks into an opening (b),† which communicates with the system of chymiferous vessels (Pl. I., $g\,v$) in the upper walls of the mouth arms. The openings (b) into the stomach alternate in the oral disk with the sexual orifices ($s\,o$).

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* One or two large white flask-shaped bodies were also observed. Compare Haeckel, *op. cit.*, p. 571.

† These openings were discovered by L. Agassiz in *Polyclonia, op. cit.* Haeckel, *op. cit.*, pp. 566–573, does not mention them. They are also omitted in his figures of *C. ornata, op. cit.*, XXXVII. 6.

Through them the food material collected from the mouths on the upper side of the oral arms by a system of chymiferous vessels (Pl. I., *g v*), is poured into the stomach cavity occupying the centre of the disk.

The chymiferous vessels of the bell of *Polyclonia* have been well described by L. Agassiz. My observations agree with his and those of Haeckel of *Cassiopea ornata*. I have nothing to add to the account which they give.

In regard to the marginal sense bodies, my observations are a little more complete than any yet recorded. The few points which can be added to our knowledge of these organs appertain only to their gross anatomy.

In external form the marginal sense bodies (Pl. I. figs. 12–16) of *Cassiopea* resemble those of *Aurelia* and *Cyanea*. There are sixteen of these structures, each of which lies at the extremity of a radius passing through one of the pear-shaped radial stripes (*e f*) which have been described in the bell. They are set in deep incisions in the bell margin, and are flanked on either side by the ocular lappets (*o l*). A "hood" (*h*) protects the sense organ on its aboral side. This structure resembles that of *Cyanea*, and is simply stretched from one ocular lappet to another. There is no aboral "Sinnespolster." The outer "Riechgrübschen" is wanting. There are no finger-like lappets, as in *Aurelia*, and only diminutive oral "sense curtains," as in *Cyanea*. The inner "Riechgrübschen" are very small.

The otocyst is mounted on a short peduncle, and is more spherical in shape than the same organ in most other *Discophora*. It seems to fit into the end of its style as an acorn into its cup, and not to be united to it by an elbow-joint as in *Aurelia* and *Cyanea*. The otoliths have a rhomboidal form and a yellow color.

An ocellus (*oc*), or cluster of pigment spots, can easily be seen through the walls of the hood. It is situated on the aboral side of the otocyst, near the enlargement of the style into the cup-shaped end into which the otocyst fits. In normal specimens (fig. 12) there is but a single ocellus to each otocyst, yet in many cases we find a style bearing an otocyst with two ocelli (fig. 16). In several instances, also, a bifurcated style supporting two otocysts (figs. 14, 15) as well as two ocelli was observed. Variations in the number of otocysts about the margin of the bell of *Cassiopea* are very common.*

Little is known of the development of *Cassiopea*. The youngest specimens taken were about an inch in diameter, and had already assumed the characteristic posture (*g a*) of the adult. In the youngest, however, the central mouth, spoken of by L. Agassiz in the young *Polyclonia*, was not observed. The larval *Cassiopea* (fig. 8) differs but little except in size from the adult as far as the oral region is concerned. The "sucker frills" (Saugkrausen) are less abundant and the large flask-shaped bodies fewer in number in the young medusa than in the adult. The coloration of the aboral side of the bell differs markedly from that of the adult. The disposition of color is as follows : —

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* *Polyclonia*, which has twelve otocysts according to L. Agassiz, may be an abnormal *Cassiopea* in which the number of sense bodies is normally sixteen.

The young medusa seen from the aboral pole is shown in Plate I. fig. 8. Sixteen radial stripes (*e*), whose periphery bounds the central region of the bell, have already appeared, and can be seen faintly showing through the transparent walls of the bell. Their general shape is cuneiform. Situated on the bell margin, and alternating with the bodies last mentioned, are sixteen triangular white spots (*t'*). These triangular spots are the velar lappets (*vl*), which are now solid and not differentiated into the three serrations which characterize the interocular bell margin of the adult. The ocular lappets (*tt*) are also found on the bell rim. They seem from the very first to arise independently of the velar lappets. They are arranged in pairs alternating with the velar lappets, and enclosing the otocysts as in the adult.

In many of the young *Cassiopeæ* which were examined, one of the oral arms was much more developed than the others. Is this a remnant of a want of symmetry in growth similar to what exists in the strobila stage of the young *Aurelia?*

Linerges Mercurius, HAECKEL.

Plate II. Figs. 3, 4, 5. Plate III. Figs. 4-8, 11, 13. Plate IV. Figs. 3-22.

Representatives of the genus *Linerges*,* probably *L. Mercurius*, are among the most abundant Discophores found in the Gulf off the Florida Keys. In the tide eddies near the Tortugas Islands, we passed through long windrows of these medusæ, reaching as far as the eye could follow. *Linerges* is locally called the "mutton-fish thimble," from its shape and the supposition, without foundation as far as I could learn, that they constitute the food of the mutton-fish. The bell is thimble-shaped, with vertical walls; its height is about half the diameter. The outer surface is covered with small excrescences or tubercles. The walls are thin and flexible. The walls of the apex are more rigid than the vertical, and less capable of motion. The bell margin is indented with sixteen deep incisions, from each of which hang alternately tentacles and otocysts. The marginal lobes left by these incisions in the bell rim are commonly carried folded inward at right angles to the vertical bell walls, resembling a discontinuous velum.

There are eight short tentacles, which hang from alternate incisions in the bell rim, and project but a short distance beyond the bell margin. They are capable of very little motion, and are probably solid.†

The lower floor or inner wall of the bell is formed of muscular fibres, and is thickly pigmented. At certain points it hangs down in spherical sacs, which will be described presently. Between this muscular layer and the inner surface of the vertical walls of the bell, below the pouches last mentioned, there is an anastomosing network of vessels, which grows more intricate near the bell margin, and finally ends in irregular dendritic marginal prolongations in the lobes of the bell. This network of tubes is formed by interstitial growth between the lower floor and the inner surface of the bell. All the anastomosing vessels unite near the upper part of the bell, and enter the stomach cavity through sixteen radial tubes. Eight of these tubes pass directly from the cavity of an otocyst to the stomach, gathering up as it goes the network of vessels, and eight others take a similar course from the tentacles to the central chymiferous cavity.

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* Swartz (Neu. Abh. d. Schwed. Akad., IX.) described in 1789, under the name *Medusa unguiculata*, a similar jelly-fish.

† Haeckel, *op. cit.*, says they are solid in related genera. The specimens of *Linerges* described by Haeckel were alcoholic, which fact is an explanation of the difference in coloration in his drawings and mine. *Linerges* loses its brown color in preservative fluids.

The common cavity into which these tubes open lies above the stomach properly so called. It is a small circular recess, bounded by the inner wall of the bell above, and the lower floor below. It occupies the central part of the bell above the stomach, with which, however, it communicates by means of a centrally placed opening in the floor. This chymiferous cavity is marked on its periphery by thirty-two pouches, which hang down into the bell cavity from its inner walls. These pouches are formed of baglike expansions of the lower floor of the bell, and are commonly found inflated with fluid. At times, also, they lose their contents, probably discharging it into the chymiferous cavity. They have a deep brown color from the growth of pigment in their walls, and are probably organs for the secretion of a biliary fluid.*

The chymiferous cavity is probably homologous with the central cavity in *Cambessa Tagi.*† It lies above the stomach in normal positions of the medusa, and communicates with it only through the central orifice already mentioned. The stomach proper of *Linerges* is bounded on the sides by folds hanging down from the inner bell walls and roofed over by the floor of the chymiferous cavity. The lateral walls of the stomach are short, curtain-like structures, which never project beyond the bell opening. The mouth is rectangular, cross-shaped, resembling closely that of some genera of hydroid medusæ. The walls of the lips are crossed by eight rows of pigment spots arranged in four pairs, each of which extends into one of the four divisions of the cruciform mouth.

Four clusters of gastral filaments are found suspended from the upper wall or roof of the stomach, in positions corresponding with the four angles of the mouth, and alternating with the extensions of the cruciform oral aperture. Each filament is dotted with crimson pigment-spots. They are in constant motion, and at times their extremities are found projected through the central opening, which leads from the stomach into the chymiferous cavity above. Their function is unknown.*

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* This conclusion seems to me more natural than that they are testes, sacs for the reception of undeveloped ova or spermatozoa, organs of respiration, or kidneys. For enumeration of their possible function and discussion of their homology, see Haeckel, *op. cit.*, p. 493.

† Grenacher and Noll, Abhandl. Senk. Gesell., X. Pl. III. fig. 3 ($c' c'$).

The marginal sense bodies of *Linerges* are very characteristic. They are eight in number, and are situated in incisions alternating with the tentacles on the bell rim. Each otocyst is very prominent, and at first glance appears to be destitute of a "hood." This impression is, however, not a true one, for the hood in *Linerges* assumes a curious and at first unrecognizable form.

When the otocyst is looked at from above it resembles a spherical sac, in the centre of which, through the transparent walls, a *single* otolith mounted on a short peduncle can be seen. The transparent sac in which this *single* otolith is contained is the homologue of the "hood" of other Discophora. If the sac be viewed from below, it will be found to be not a closed capsule, but an open one, or that the wall of the sac is wanting on the under surface. The hood has thus in *Linerges* assumed a caplike form reaching outward so as to envelope the otolith on the upper side, and to leave the lower unprotected. The otolith is a single spherical body, and not a rhomboidal structure as in *Cyanea* and many others. There is no prominent ocellus.†

No representative of a "Sinnespolster," or of an outer "Riechgrübschen," was seen. Oral sense curtains and lappets are also wanting.

The ovaries hang from the inner bell walls and seem to be in free communication with the stomach. They are four in number, and have a horseshoe shape. Each ovary is made up of two halves, united together in such a way that the gland has the peculiar arched form shown in the plate. The ovaries have a dark brown color.

The ova (Pl. IV. fig. 7) are laid in small black clusters, composed of from fifteen to twenty eggs, which are agglutinated together. A segmentation of the ovum begins shortly after the egg is dropped, when it becomes more transparent and separates from its union with others of the same cluster.

The first change in the segmentation is the elongation of the ovum into an ovoid shape, blunt at one pole and more tapering at the opposite. The first plane of segmentation divides the egg into two unequal segment spheres; one formed from the pointed, and the other from the blunt pole of the ovum.

Shortly after this first cleavage of the egg into two unequal spheres, a second plane divides the larger of the two into two other spheres which are also of unequal size, and we have an egg in which three segmentulæ can be seen. All of these parts now assume a pyriform shape, and new segment-spheres are constricted from them in the same way that the two spheres were first formed from the original ovum. At the end of the second day after ovulation the ovum was in the condition shown in fig. 12. The segmentation takes place in the water, and not in the sacs hanging from the inner walls of the bell.* The planula which follows the morula last described does not differ from the planula of other medusæ. It is an oblong spherical body richly ciliated and capable of rapid motion.

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* These filaments may be homologous to the "sexual filaments" of *Cyanea*. They resemble closely in position the early condition of these structures in the ephyra of *Cyanea*. See Bull. Mus. Comp. Zoöl., VIII. 8, Pl. VII. figs. 8, 9, 10.

† There are many scattered pigment-cells, which may be an ocellus, in the region of the style where this structure is commonly found.

Intermediate stages of growth between the planula and that which is probably the ephyra of *Linerges* were not observed, so that I cannot say definitely whether *Linerges* has a direct development or not.

A medusa which resembles *Linerges* very closely, and which may be its ephyra, was found in great abundance in the water about Fort Jefferson (Tortugas Islands) at the same time that *Linerges* was so common.†

The shape of the youngest ephyra (fig. 4) is very similar to that of the young *Cyanea*. The bell is flat, disk-shaped, and with its margin continued into eight pairs of prominent lappets, two of which are represented in the figure. The walls of the bell have a yellow-brown color, and the surface (upper) is dotted with small round pigment-spots. In the deep incisions around the bell margin hang, alternating with each other, eight tentacles and as many otocysts. The tentacles are suspended from the deeper and narrower incisions of the bell rim, while the marginal sense bodies are found in the remaining indentations which separate adjoining pairs of marginal lobes.

The tentacles are single, hollow (?) bodies, which do not project beyond the tips of the marginal lobes when extended. As compared to the diameter of the bell they are relatively larger than the same bodies in *Linerges*.

The marginal sense bodies resemble closely those of *Linerges*, and consist of a single otolith of spherical shape enclosed in a capsule-like hood which is open below (figs. 16–18). It differs from *Linerges* in possessing an ocellus or well-marked black pigmented region at the base of the peduncle which bears the otocyst. The existence of an ocellus in the young, and not in the adult, is a very anomalous fact, and never before mentioned in any Discophore. It even leads me strongly to doubt whether I am right in considering this ephyra the young of *Linerges*. The ocellus of the ephyra is a complicated structure. It is not a simple mass of black pigment-cells, but resembles the complicated eye-spot of medusæ like the genus *Tamoya*. In the middle of the base there is a lens-shaped, apparently transparent body, which rises above the surface of the otocyst style, and around it, in which it seems to be imbedded, we find the black pigment (fig. 17). In this regard it is different from the ocellus of most *Discophora* in which the ocellus seems to be a simple pigment-spot on the peduncle of the otocyst.

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* An observation which disproves the theory that the subumbral pouches are receptacles for the developing young.

† The resemblance between this ephyra and members of the family *Ephyridæ*, Haeck. is very close. It approaches very near the genus *Nausicaa*, Haeck. The figures of this ephyra made use of in my description were drawn from nature by A. Agassiz.

The mouth of the ephyra is simple, quadrate, and there is a single gastral filament in each quadrant. The lips are simple raised ridges from the lower floor of the stomach, and assume a cruciform outline when seen from beneath. The chymiferous tubes are broad extensions from the stomach to the tentacles and otocysts. No extensions of the central cavity as yet push out towards the marginal lobes.

In an ephyra still older than that just described, we have anatomical differences of a most important kind. While the general outline, color, and pigmentation is about the same as in the former, important additions have taken place in the internal anatomy. Prominent among these is the formation near the base of each tentacle of a spherical body filled with cells. These bodies are seen in fig. 3. They are the beginnings of the ovaries which in later stages assume a different form, and by coalescence form the horseshoe sexual glands of the adult. Intermediate between the broad prolongations from the stomach cavity, which in the young ephyra extend to otocyst and tentacle, smaller blindly ending tubes push out in the direction of the marginal lobes. They are as yet very short, hardly entering more than the base of the lobe.

By far the most interesting anatomical structure in this as well as subsequent stages of the ephyra is the differentiation of the stomach cavity into an upper and lower story, by the growth of a continuation of the lower floor of the bell into a partition in this structure. In an ephyra as young as fig. 3, this differentiation has been accomplished, and the only communication between the stomach proper and the chymiferous cavity above is through a centrally placed opening in the lower floor.

The number of gastral filaments in each cluster has very much increased, and their ends often project through the central orifice in the wall which divides the stomach from the chymiferous cavity, just as also happens in the adult *Linerges.*

In the oldest ephyra (fig. 15) the approximation in shape and color to the adult *Linerges* has gone still further. The depth of the incisions which separate the marginal lobes has diminished, and the bell has become more thimble-shaped, the apex rising and the walls becoming more vertical instead of horizontal. The circular muscles in the lower floor have also clearly differentiated themselves from the inner wall of the bell.

One of the most important changes which has taken place is in the form of the eight ovaries. As the spherical glands of the ephyra (fig. 3) grow in size with the development of the larva, two bulges form on adjoining sides near the ends, and gradually approach each other. As growth goes on, these projecting portions join, and we have the eight glands fused into four, each assuming a crescentic shape, as in the adult *Linerges.* The mode of growth of the ovaries has been one of the strongest facts pointing to the relationship of the ephyra to *Linerges.*

SIPHONOPHORA.

Stephanomia* Atlantica, sp. nov.

Plate V. Fig. 1. Plate VI. Figs. 18-22.

A new species of *Stephanomia*, M. E. was taken by us at Tortugas.

The most marked characteristic of the genus *Stephanomia* (*Forskalia*) is the multiserial arrangement of the swimming bells. Instead of being placed biserially on the stem, or with one row of bells at each end of diameters passing through the axis in one and the same plane as in *Agalma*, Esch., *Agalmopsis* (sensu strictiori) and *Halistemma*, Huxley, the nectocalyces of *Stephanomia* are arranged in several series, with their openings situated at the extremities of axes or diameters passing through the nectostem in several vertical planes, so that they seem to open on all sides, as shown in Pl. V. fig. 1, *n*. The nectocalyces are much more numerous than in any of the genera mentioned, and the motion which they impart to the animal is of a more varied kind. This genus is the only Physophore which has a multiserial arrangement of nectocalyces on the nectostem.†

The polypites are mounted on long peduncles (*w*) corresponding to the "Wimperwulst"‡ of *Agalma* and related genera. From the distal end of this peduncle, near the base of the feeding-polyps, hang also clusters of undeveloped tentacular knobs (*j*) and covering scales. The base of the polypite when retracted is enlarged into a spherical body, as shown in Pl. VI. figs. 20, 22. This portion of the feeding-polyp is formed by the contraction of the base of the polypite. The walls of the feeding-polyp are thickly pigmented (Pl. VI. fig. 22) near the base with dark red pigment, which renders these bodies very prominent.

The tentacular knobs (Pl. VI. figs. 18, 19, 21) have a single terminal filament, a long pedicle, and are destitute of an involucrum. They arise from tentacles as those of other Physophores. The tentacles from which they hang take origin from the base of the polypite, near its union with the peduncle. The axis is large, muscular, and spirally coiled.* The color of its wall is yellow and orange. The float is in no respects peculiar, and bears around the opening by which the air-sac communicates with the surrounding water a number of regularly arranged pigment-spots. The nectocalyces are arranged in many rows, opening laterally in spirals on all sides of the animal. The most distally placed bells from the float are the oldest, as in other Physophores. Directly under the float there is a small cluster (*u*) of undeveloped swimming-bells. Each nectocalyx has a cubical form, the flat faces of which conform to the surfaces of adjoining bells. The bell has in other particulars a great resemblance to the nectocalyx of other Physophores, and does not seem to differ from that of *Forskalia contorta.* The course of the radial tubes is like that in *Agalma.* At the union of the radial tube with the ring canal on the bell margin, there is a large yellow spot, which is an ocellus or sense organ of the same kind as similar bodies in certain hydroid medusæ. On either side of it, there is a short papilla of unknown function. In the undeveloped nectocalyx we find a single large yellow spot of this kind, which forms a very conspicuous body on the bell margin. Later in the growth of the nectocalyx, its comparatively large size diminishes. We should expect, if anywhere among the Physophores, a development of the sense organs in *Stephanomia.* Its motion through the water is so rapid that organs of this kind are necessary. Ocelli on the margin of the nectocalyx are, however, not peculiar to *Stephanomia.* In our common *Diphyes* similar ocelli are found, three in number, on the margin of the anterior nectocalyx. The attachment of the covering-scales to the base of the polypites and the distal end of the peduncle imparts to the polyx stem of *Stephanomia* a diameter relatively greater than that of other Physophores. In *Agalma* the covering-scales spring from the base of the polypite, of which the peduncle is very short. In *Stephanomia*, however, the pedicle, which bears the feeding-polyp, is so long that the covering-scale seems to hang from a point midway between the axis of the animal and the mouth of the polypite. The tastern do not differ from the tastern of other Physophores, except that they have long peduncles, as is the case also with the polypites.

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* In this account I regard *Forskalia*, Köll., a synonym of *Stephanomia*, M. E. (Vide Bull. Mus. Comp. Zoöl., Vl. 7, pp. 132-134).

† A single species of *Physophora*, *P. tetrastica*, is said by Philippi and Delle Chiaje to have four rows of nectocalyces. This is probably a mistake. (Vide Keferstein u. Ehlers. Zoologische Beiträge, p. 30, note.)

‡ The base of the polypite from which the tentacular knobs bud. Claus, Ueber Halistemma Tergestinum, p. 35. Peron's *Stephanomia* may have been an *Agalma*, Esch. *Stephanomia*, Huxley, is nearer *Agalmopsis*, Sars, than it is to *Stephanomia*, Peron. *Agalmopsis*, Sars (1846), has the priority of *Stephanomia*, Huxley (1859). *Stephanomia*, Milne Edwards, has pedunculated polypites, which are not figured in *Stephanomia*, Peron. Milne Edwards's description is such that there is no doubt of his genus *Stephanomia*. If we abandon Peron's generic name *Stephanomia*, as applied by Milne Edwards, for Kölliker's later name, *Forskalia*, why should we retain it as applied by Huxley eleven years later?

The male and female bells arise from the same tastern at their junction with their peduncles. The colony is monœcious. The sexual bells resemble closely those of *Agalmopsis gracile*, sp. nov. In its motion through the water it is one of the most active of all the Physophores. The combination of so many series of nectocalyces can propel it in almost any direction with the greatest ease, whereas in *Agalma* and some others these propelling organs are obviously placed in a disadvantageous position for quick movement. As it passes through the water in the line of its axis, it sometimes combines a rotation of the stem with the direct forward motion.

When the colony is quiet in the water the peduncles of the polypites and the organs which they bear are widely extended, so that its diameter is very great as compared with its length. As the colony begins to advance in the line of its axis the peduncles are retracted and the bracts are pressed closely together in order to offer less resistance to the direct advance of the animal.

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* In the same way as *Forskalia contorta.*

The greatest care must be taken in transferring the colony from its native element into aquaria, otherwise it will drop all its nectocalyces and the bracts will fall off, their attachment to the colony is of such a fragile nature. *Stephanomia* is much more delicate than most other genera of Physophores.

Agalma papillosum, sp. nov.

Plate V. Figs. 5, 6. Plate VI. Fig. 27.

The genus *Agalma*.* Esch., is represented by at least two species in Florida seas. One of these is *A. elegans*, which is also found in Narragansett Bay. The other is a new species, *A. papillosum*, of which two immature specimens were found near Key West, Florida.

A papillosum resembles *A. elegans* in many particulars of structure, and might be mistaken for it. There is, however, this important difference between the two American species of the genus.

The most important characteristic of *A. papillosum* is the presence, on the outer surface of the covering-scales and upon the swimming-bells, of short papillæ, swollen at their extremities into spherical knobs (Pl. V. figs. 5, 6). As far as I have studied other genera of Physophores there are none where similar appendages are found on these parts.

The axis of the specimens taken was very short, and seemed to indicate an immature animal. A single feeding polyp (*p*) is found hanging from the end of the stem, and several tastern (*d d′ d″*) could be seen protruded between the covering-scales (*c*). The float (*a*) is large, thickly pigmented at its apex with crimson spots. It has a small aperture communicating between its air-sac (*a a*) and the surrounding medium.

The nectocalyces were all immature and few in number. The largest swimming-bell (*n*) was about half grown, as its relative size seemed to indicate, and is shown, as seen from above, on Plate V. fig. 6. In most particulars of internal structure the swimming-bells resemble the young nectocalyces of

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* I include in the genus *Agalma* those long-stemmed Physophores with a biserial arrangement of the nectocalyces and tentacular knobs, composed of a coiled sacculus, covered by an involucrum, and terminated by a vesicle and two lateral filaments. (Eschscholtz, Oken's Isis, 1825, 1., and System der Acalephen, p. 150.) For a discussion of the limits of the genera *Agalma*, *Agalmopsis*, and *Halistemma*, see Bull. Mus. Comp. Zoöl., Vl. 7, p. 132.

Sars evidently had two or three genera of Physophores which he called *Agalmopsis elegans*. One of these may have been my *Agalma elegans* (Fauna Littoralis Norvegiæ, pp. 32–44, Taf. 5, 6). The first form described by him had a tentacular knob like *Halistemma rubrum*, with a well-developed involucrum, which is wanting in *Halistemma*, Huxley. Such a knob is not very unlike that of *Agalmopsis Tergestinum* and *A. gracile*.

A. elegans. A characteristic feature in their anatomy is the prolongation of the upper wall of the bell cavity into two symmetrically placed recesses (*h n*), one extending into each of those prolongations of the nectocalyx which embrace the axis. The sides of the swimming-bell, on the external surface, are sparingly covered with papillæ which are enlarged at their ends into a spherical knob formed of large thread-cells (Pl. VI. fig. 27).

The covering-scales are more rectangular in outline than those of *A. elegans*, and are crossed by several longitudinal ridges (*r*) bearing lasso-cells closely crowded together. Their exact shape was not determined, as only two specimens were taken, and these were evidently larval. The sides and outer convex surface of the bract bear the characteristic papillæ which have been spoken of as found on the walls of the nectocalyces.

The tastern (*d d′ d″*) are more slender than those of *A. elegans*, and have a greater flexibility of motion. Their extremities protrude far outside the limits of the covering-scales, and their very tips are armed with clusters of lasso-cells. From the base of each there hangs a long, flexible, highly contractile filament (*e*), which is commonly carried retracted at its base near the axis.

There is but one feeding-polyp, which appears to be the metamorphosed yolk mass, and is found at the lower end of the axis. The single tentacle (*t*) suspended from its base bears tentacular knobs (*k*) like those of *A. elegans*. Immature pendants (*j*) in all stages of growth are found at the base of the polypite, on the wimperwulst. The tentacular knob is composed of a coiled sacculus of dark red color, enclosed in an involucrum and terminated by a vesicle and two lateral filaments. These filaments are short and stunted, and seem to indicate that the specimens studied were immature.* No sexual bells were observed.

Agalmopsis fragile, sp. nov.

Plate V. Fig 2. Plate VI. Figs. 16, 17, 23, 24, 25.

In 1878 Claus † described from Trieste a new Physophore, to which he gave the name *Halistemma Tergestinum.* Metschnikoff refers the same, taken at Villa Franca at about the same time, to *Stephanomia picta*, sp. nov. Metsch. I have already discussed ‡ the synonomy of this genus.

A single specimen of an *Agalmopsis* closely related to *S. picta*, Metsch. (*H. Tergestinum*, Claus), was found at Key West. So close is its likeness to the Mediterranean species that it is probably the same. Direct comparison is necessary to prove their identity.

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* This species is very different from *A. elegans* of about the same age. *A. elegans* with one polypite has *two* kinds of tentacular knobs and a prominent network of red pigment on the feeding polyp. It is destitute of the papillæ found on the nectocalyces and scales of *A. papillosum.*

† Ueber Halistemma Tergestinum, n. sp., in Arbeit. d. Zool. Inst. zu Wien, Heft I.

‡ Bull. Mus. Comp. Zoöl., VI. 7.

The axis (*b*) of *Ag. fragile* is very flexible, while the nectocalyces and scales admit of more motion on each other than is commonly the case among Physophores. These appendages also are very transparent and small in size as compared to the length of the colony. The whole animal is more slender than an *Agalma*, and the appendages, in respect to their size, less conspicuous. The float (*a*) does not differ from that of other Physophores. It is relatively large, and bears apical pigment-spots of crimson color. Similar colored spots are likewise found at intervals along the length of the axis, especially on that portion of it which bears the swimming-bells and is known as the nectostem. This peculiar distribution of pigment on the stem is confined to the two species *Ag. picta* and *Ag. fragile.* In other genera colored spots are found on the axis, but they are not so prominent as in these two species of *Agalmopsis.**

One of the main differences between the nectocalyces of *Agalmopsis* and those of *Agalma* is the existence of three or four bright orange ocelli (*o*) on the bell margin near the terminus of the radial tubes. The course of these vessels in the walls of the bell is almost identical in the two genera.

The portion of the axis upon which the bracts are borne is very long and highly flexible. The covering-scales (*c*) are small, inconspicuous, and transparent. They have a rectangular shape, and are fastened to the axis by means of a short peduncle. A blindly ending, medially placed tube penetrates their whole length on the inner concave surface. It opens into the stem cavity by an elbow-joint.

The polypites (*p*) are long, slender, flask-shaped bodies, which are very prominent on account of the network of bright crimson pigment on their sides and bases. The tentacles carry tentacular knobs (Pl. VI. fig. 17), which have a bell-shaped involucrum and a single terminal filament without a vesicle. The sacculus is tightly coiled, and has a dark red color. It bears near the attachment of the involucrum a double row of prominent thread-cells. The male and female bells hang in clusters from the base of the tastern (fig. 16, *s*), and are not separated from each other on different regions of the axis. The male bells (fig. 25) are smaller than the female (fig. 24) and have a crimson color. The female bells are colorless. As is true of most Physophores, the colony is monœcious.†

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* The tentacular knobs of *Agalmopsis utricularia*, Claus, are so different from those of other Physophoridæ that I have considered it a new genus (Bull. Mus. Comp. Zoöl., VI. 7). It may be known as *Calliagalma utricularia.*

† In *Nanomia* according to Mr. Agassiz the two sexes are not combined in the same colony. (N. Amer. Acal., p. 208; Seaside Studies, &c., p. 80.) *Agalmopsis, Agalma, Physophora, Athorybia, Halistemma, Stephanomia*, and *Praya* have both male and female bells on the same stem. The same is said to be true of *Hippopodius. Abyla, Apolemia*, and *Diphyes* are probably diœcious. Sexual organs of but one kind are known in *Rhizophysa.* They resemble those of *Physalia.*

Nanomia will also be found to bear male as well as female sexual bells on the same axis, as it is probably the young of *Agalmopsis.* My reason for regarding *Nanomia* as the young of *Agalmopsis* and not of *Agalma* will be found in Bull. Mus. Comp. Zoöl., VI. 7, p. 141.

Rhizophysa gracilis, sp. nov.

Plate VI. Figs. 1 - 6.

One of the most interesting Physophores found by us is a new species of *Rhizophysa*.

It differs from *R. filiformis*, Lam., in the position of the sexual bodies and the form of the tentacular knobs. Its differences from *R. Eysenhardtii* are still greater. *R. gracilis* has two kinds of tentacular knobs, neither of which are present in *R. Eysenhardtii.* I am unable to say whether my species is the same as any of those described by Studer.* *Rhizophysa* has a long, thread-like axis, destitute of swimming-bells, covering-scales, and tastern. At one extremity there is a float which, in all species of the genus, is relatively larger than in other Physophores, with the exception of the single genus *Physalia.* The axis is very contractile, coiling up when touched at the base of the float, and then leisurely extending itself to its normal length. The stem walls seem to be extremely sensitive to the touch of a foreign body.

The float (fig. 2) is similar to an enlargement of the stem at one extremity, and is formed of two parts, an external float and an internal air-sac. The walls of the float are composed of two layers, and have the shape of an elongated sphere (prolate spheroid). The outer walls are dotted with small cells, irregularly placed. These cells are characteristic of the species, or at least are not found in *R. filiformis*, the common *Rhizophysa* from the Mediterranean. At the apical pole of the float there is an opening through which the cavity of the air-sac communicates with the surrounding medium.

The air-sac has the general form of the float, but is much smaller, and hangs inside this structure, being suspended from its upper pole. The cavity of the air-sac is in free communication with the external water through the apical orifice of the float. Around this opening there are large patches of dark brown pigment. The walls of the lower hemisphere of the air-sac (*g*) are thicker than those of the upper, and have a yellowish green color. From the lower surface of the air-sac, confined to the hemisphere (*g*) with thickened walls, there hang into the cavity of the float many finger-like pouches, which are sometimes bifurcated at their extremities, In *R. gracilis* these appendages to the air-sac are open at their distal ends, so that their cavities seem to freely communicate with that of the float. On one side of the base of the float, projecting from its external walls, is an excrescence (*e*) filled with small globules whose function is unknown.† A similar appendage to the float has not been seen by me in *R. filiformis.*

The polypites (*p*) of *R. gracilis* resemble closely in shape those of *R. fili*

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* Zeit. f. Wiss. Zool., XXXI.

† A natural homology of this body is that it is an undeveloped polypite. The transparent spheres within are probably bubbles of air which have made their way into the float through its apical opening.

formis, but are stouter and covered with small regularly placed patches of pigment, whose color was not noticed (fig. 4). The single specimen which we found had four feeding-polyps.

The tentacles (fig. 4) arise from the base of the polypite, and closely resemble the tentacles of *R. filiformis.* Along their upper side, near their proximal end, they bear many simple buds,* which are undeveloped tentacular knobs (fig. 4). The pendants, therefore, in this genus, seem to bud from the tentacles, and not, as in *Agalma*, from the base of the polypites. These buds pass by successive changes into well-developed tentacular pendants of two kinds. The adult form of these two kinds of tentacular knobs does not differ as radically in their anatomy as that of the pendants of *R. filiformis.*

The first and more numerous tentacular pendant consists of a simple coiled sacculus (fig. 5), without involucrum, mounted on a long, flexible peduncle. The termination (fig. 5′) of the sacculus is trifid, consisting of a prominent median projection and smaller lateral protuberances. The tip of each bears a black pigment-spot. The whole surface of the knob is abundantly supplied with thread-cells.

A second kind of tentacular pendant, similar in some respects to the former, was also observed (fig. 6). It differs from the former in having an undivided tip which bears a small pigment-spot. The second form of tentacular pendant is more slender than the first, and may be found to be simply the immature condition of that described above. The "first form" of tentacular knob in *R. gracilis* corresponds part for part with the "first form" of knob in *R. filiformis.* Representatives of what are known as the "second" and "third"† kind of pendant in the latter species seem not to exist in the present species, *R. gracilis.* The whole outer surface of the tentacle is thickly covered with large lasso-cells.

The sexual organs (*s*) differ in shape, size, and position from those of most other Physophores. They resemble most closely homologous structures in the genus *Physalia.* Instead of arising in clusters from the stem, each placed midway between two polypites as in some genera, or from the base of a taster as in others, they hang from the axis at a point immediately below the base of attachment of the upper polypite.‡ In the single specimen studied they are wanting on the other feeding-polyps.

The cluster (fig. 3) has a botryoidal shape, and hangs from the axis by a single slight peduncle. The pedicle of the sexual bodies opens directly into a spherical body, as shown in fig. 3. This body varies in size and shape, and contains a simple cavity. It is sometimes so contracted that it is indistinguishable from the peduncle itself. There are four clusters of sexual bodies arising from this enlargement of the peduncle. Each of these subordinate clusters is attached by its own peduncle, and bears several buds in various stages of growth. Of these buds the more proximal are generally the most developed, and they have not yet taken on the form of a bell. The axis and peduncle of each cluster is very contractile. The sexual cluster is a very prominent body on the stem, swaying backward and forward with passing currents of water. None of the single bells which form this cluster were observed to separate from the axis, nor were their contents seen to be discharged. In none of the buds could an egg be distinguished, and it is impossible to tell whether the animal was male or female, so little is known of the difference between the sexes in the genus *Rhizophysa*. "Mace-like" sexual organs, such as are found in *R. filiformis*, probably develop into sexual glands similar to those which we have described in *R. gracilis*.*

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* Huxley, *op. cit.*, Pl. VIII. fig. 18, represents similar buds near the proximal end of the tentacle.

† By the "second" and "third" form of tentacular pendants in *R. filiformis,* I refer to those structures which Gegenbaur (Beit. z. n. Kennt. d. Schwimp., Taf. XVIII. figs. 8, 9) calls respectively the *Handförmiges Angelorgan* and the *Vögelkopfahnliches Organ.*

‡ They occupy a similar position as regards the polypites as the female bells of *Agalma.*

Many parasitic Crustacea were found infesting *R. gracilis*. They clung to the float and polypites with such pertinacity that it was almost impossible to tear them away without rupturing the *Rhizophysa*. Six of these parasites were found upon a single Siphonophore. The same, or a closely related parasite,† is also one of the greatest enemies of the genus *Physophora*.

Athorybia formosa, sp. nov.

Plate V. Figs. 3, 4. Plate VI. Figs. 7-14.

A new species ‡ of *Athorybia* was taken at the Tortugas. This remarkable genus has never before been found in American waters, and very little is known of the anatomy of the other species, *A. rosacea*, although it is very common in some parts of the Mediterranean. §

Athorybia differs from other *Physophoridæ* in the absence of a long axis and nectocalyces, although possessing a well-developed float, and bracts or covering-scales. The form and development of these latter structures impart a peculiar outline to the *Athorybia.* The float (*a*) is large, pear-shaped, and sometimes it protrudes above the circlet of covering-scales, as in the figures of *A. melo*, Q. & G., but generally it is drawn below the upper edges of the bracts so that it can only be seen by looking through the body of the scale. When seen from above, the float has a cherry or claret-red color on the periphery surrounding a dark brown middle. In the centre there appears an opening giving a free communication between the air-bladder (*a a*) and the surrounding water.

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* See Proc. Bost. Soc. Nat. Hist., XX., Note on *Rhizophysa*. The likeness of the sexual organs of *R. gracilis* to the bundles of "medusa buds" in *Physalia* and *Tubularia* is very striking. Whether the medusoid buds always remain attached in this Physophore, as in *Tubularia*, is unknown. The resemblance between the sexual organs of *Physalia* and *R. gracilis* is so close that the embryology of the two genera must be very similar.

† The genus and species of this Crustacean were not determined.

‡ Three species of *Athorybia* (sensu strictiori) are described by Eschscholtz, *A. heliantha*, *A. melo*, Q. & G., and *A. rosacea*. Since his time nothing has been added to his descriptions of the two former. Practically what is known of the anatomy of the genus we owe to the accounts of *A. rosacea* by Kölliker (Die Schwimmpolypen oder Siphonophoren von Messina, pp. 24–28, Pl. VII.), Sars (Middelhavets Littoral Fauna, Nyt. Magaz. f. Natur., X. pp. 6, 7), and Huxley (*op. cit.*, pp. 86–89, Pl. IX.). *A. formosa* differs from their account of the anatomy of *A. rosacea* in the form of the tentacular knob.

§ Rare at Naples and Villa Franca.

The air-bladder (*a a*), which hangs within the float, is an elongated sac suspended from the inner walls of the upper pole of the float. It resembles closely the air-bladder of *Agalma*, and is destitute of those finger-like processes which characterize the same structure in *Rhizophysa.* No communication was observed between the cavity of the float and that of the axis. Swimming-bells are wanting in *Athorybia.*

The covering-scales arise from all sides of the short axis below the float, and in their method of attachment to the rudimentary stem are not unlike the petals of a flower. When seen from the side, they give the whole animal a rhomboidal shape. The covering-scales (Pl. VI. fig. 14) are curved and spatulate, with the convex surface turned outward. At its origin the bract is narrow, but gradually as it recedes from that point it widens, and its bounding edges are indented with a pair of teeth, one on each side about two thirds the distance from the attachment to the distal rim of the scale. The outer, convex surface of the covering-scale is slightly rounded laterally, and is crossed by four rows of lasso-cells (*l*) arranged in longitudinal lines.* When the scale is seen from one side it appears serrated along these four lines. The scale of the *Athorybia* stage in the young *Agalma* has a somewhat similar serrated appearance. Along the medial line of the bract, on its inner concave surface, there runs a longitudinal vessel which communicates with the stem cavity and ends blindly at the most distal extremity of the scale.

From their position of attachment, as commonly carried, the scales at first extend outward almost at right angles to the axis of the float, and the natural curvature which they have imparts the somewhat spherical outline to the animal. These covering-scales can be made to extend themselves or draw together, receding from or approaching the line passing through their attachment and the apical portion of the float. This expanding and contracting power of these bodies is limited to the extremities, which are moved apparently by muscles in the base of the scale and its peduncle. The motion of the scale may in part make up for the loss of swimming-bells and propel the animal in the water. As far as my observations go it is rather sluggish, and but poorly adapted for rapid progression. As the colony floats along, the covering-scales are generally extended to their greatest width, but when alarmed the scales are contracted closely together around the feeding-polyps and those other organs which arise near their base.

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* Huxley (*op. cit.*, p. 86) says the outer surface of the covering-scale in his species of *Athorybia* is crossed by *six* rows of small thread-cells. Kölliker describes the bract of *A. rosacea* as crossed by *five* or *six* white ribs, formed of small lasso-cells which sometimes traverse the whole length of this structure and sometimes do not. The same may be said of the lines of lasso-cells in the bract of *A. rosacea*, with the exception that in no specimen were there more than four ribs of these bodies. The specimens which were taken may have been immature, and other specimens may be found with six lines of these cells, as in *A. rosacea.*

The polypites, tastern, and sexual bells arise from a slight enlargement of a structure corresponding to the axis of the other Physophores. This enlargement does not differ greatly from a similar sac at the extremity of the stem of the genus *Physophora*. The polypite (*p*) resembles the same structures in other Siphonophores. They are long, flask-shaped bodies, projecting beyond the covering-scales (*c*) when extended, and have a mouth at the free extremity. The walls have a pink color with patches of dark crimson pigment near the base of the feeding-polyp. From each polypite, near its origin, there hangs a single tentacle. This tentacle (*t*) is dotted along its whole length by secondary appendages or tentacular knobs (*k*), of which there are two very different forms.

The existence of more than one kind of tentacular pendant in an adult Physophore * has up to this time been thought peculiar to the genus *Rhizophysa*. Two forms of these bodies exist in the young of several genera. In the young *Agalma* we find the permanent knob of the adult coexisting with an embryonic form. The same is true of the young *Agalmopsis* and *Nanomia*. Each kind of knob, however, in the larval Physophore, is limited to its own tentacle, and in the case of the embryonic knob the tentacle itself has the same provisional nature as the structure which it carries.

The adult *Rhizophysa* † has three different kinds of tentacular knobs hanging from one tentacle, and as far as we now know none are embryonic. A similar condition exists in *A. formosa*, with the exception that there are here two forms of tentacular knobs instead of three.

The first and more numerous kind of tentacular pendant (Pl. VI. figs. 9, 10) is in many respects like that of the adult *Agalma*. It has a sacculus (*d*), an involucrum, and two terminal filaments (*b*), one on either side of a spherical bladder or vesicle (*c*). The terminal filaments are, however, shorter than those of *Agalma*, and are commonly carried stiffly elevated like two horns.

The peduncle of the knob is very flexible and of moderate length, admitting a free motion of the pendant in all directions. The involucrum closely surrounds the sacculus, and its walls are with the greatest difficulty distinguishable from those of the latter body which it contains. The saccalus has a single coil upon itself, and its walls have a dark crimson color. At its base there are rows, generally two in number, of large lasso-cells, homologous to similar bodies in the knob of other Physophores.

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* See reference to Sars's genus *Agalmopsis* on preceding pages.

† Proc. Bost. Soc. Nat. Hist., XX. These three kinds of knobs in *R. filiformis* are distinct from their earliest embryonic condition, and do not develop one from another.

The most peculiar structure in the anatomy of the knob is the prolongation of the margin of the involucrum on its lower side into a conical appendage (*a*), which extends out from the knob slightly beyond the vesicle. This conical body appears to be solid, and is crossed by lines or annulations, as shown in figs. 9, 10. It has a yellow color, and may be called the apex.

If now we compare the first kind of knob in *A. formosa* with that of *A. rosacea*, Esch., we find this important difference between them. In *rosacea*, according to Kölliker, there is a "stalked elongated capsule" hanging to the knob at its base, near the origin of the involucrum. That capsule is undoubtedly homologous to the apex (*a*) of the knob in *formosa*. Its closest homology, however, is with the "second kind" of knob in *A. formosa*, as we shall show presently.

Sars * has already compared the knob of *A. rosacea* with that of *Agalma*. The resemblance of the first kind of pendant in *A. formosa* to that of *Agalma* is even more striking, since it possesses an involucrum of a form which has not been observed in *A. rosacea*.

A second kind of tentacular knob (figs. 7, 8) is sparingly scattered along the tentacle of *A. formosa*. Besides being less numerous, it is also much larger than the former, with which it is homologous. It may eventually be found to have been developed from the preceding. This knob has one of the most peculiar forms which this organ, highly variable among Siphonophores, assumes. Its general shape is shown in figs. 7, 8.

The knob, when seen from the side (fig. 8), has a pear shape, and hangs from a short flexible peduncle. The great mass of the pendant is made up of a very large involucrum or structure of the same homology. The walls of this body are very thick, and seem to be composed of large cells. At one end it is continued into dendritic branches (*a a*) of a yellow color. The body of the involucrum is transparent, and through its walls there can be seen a crimson and orange-colored sacculus (*d*). The sacculus is not coiled, as is generally the case with other Physophores, but has a simple curved shape, and in its walls can be traced the rows of large thread-cells, which are a common feature of all these organs.

Fastened to the upper side of the involucrum, near its articulation with the peduncle, there spring three bodies very similar to those found on the first kind of knob. One of these structures is the ovoid vesicle (*c*), and on each side there rises a short lateral filament (*b*). These organs differ in no respect from the same in the former kind of pendants.

The most exceptional feature in the second kind of knob in *Athorybia* is seen in the structure of the distal extremity of the involucrum or the apex (*a*). The apex (fig. 8, *a a*) is bifid at its base, and after a basal bifurcation each part subdivides into many smaller unbranched divisions. Each division has the general appearance of the apex of the first kind of knob. It is capable of great extension and retraction, and when drawn back has a corrugated surface, like similar branches in the "Handförmiges Angelorgan," described by Gegenbaur in *Rhizophysa*. I have already (Bull. Mus. Comp. Zoöl., VI. 7) compared the undeveloped knob of *Physophora hydrostatica* and that of *Athorybia*.

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* *Op. cit.*

The tastern * (fig. 13) of *A. formosa* are very long, highly flexible bodies of pink color, protruding through the spaces left between adjacent covering scales. They are in continued motion, and resemble, with the exception of their color, more the filamentous bodies found between the swimming-bells of *Apolemia* than true tastern. Their tips bear several large thread-cells. They were not observed to bear tentacles.

A. formosa is monœcious. The female bells (fig. 12) are borne on short stems,† and have a botryoidal shape. Each bell contains a single ovum. The course of the chymiferous tubes in the bell walls is similar to that in *Agalma*. The male bells (fig. 11), like the female, take the form of grape-like clusters on short stems. They are smaller than the female. The male and female clusters are colorless, and the bell-walls transparent.‡

Praya, sp.

Fragments of a large *Praya*, too mutilated for specific identification, were taken on two occasions at the Tortugas Islands. *Diplophysa*, sometimes called the diphyizoid of *Praya*, has been taken in Narragansett Bay.§ It was not collected in Florida.

Galeolaria aurantiaca, Vogt.‖

Plate VI. Fig. 26.

Galeolaria (*Epibulia*) was taken on two occasions. It is unfortunate that only the posterior nectocalyx was found. Although this is sufficient to deter-

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* Huxley (*op. cit.*) does not mention these structures in his *Athorybia*. Kölliker's description of them is much the same as that which is here given. The tastern of the two species seem to have much the same form.

† Huxley (*op. cit.*, p. 87) says that in his *Athorybia* a single stem bears both male and female bells, as well as small tastern. According to Kölliker (*op. cit.*, p. 28), the male bells in *A. rosacea* are isolated, and a *single* male bell is found with a grape-like cluster of female bells near the base of a polypite. In *A. formosa* male and female bells are found in clusters of about equal numbers.

‡ My measurements of the size of *A. formosa* are about the same as those given by Kölliker for *A. rosacea*. They are larger than Förskal's or Huxley's measurements of the *Athorybiæ* which they had. *A. formosa* is half an inch in diameter (distance taken at right angles to the axis, when covering-scales are extended).

§ Bull. Mus. Comp. Zoöl., VI. 7, and VIII. 8.

‖ Sur les Siphonophores de la Mer de Nice. Mem. de l'Inst. Genev., I. pp. 72, 73, Pl. IV. figs. 12, 13.

Since my return from Florida, the U. S. Fish Commission has sent me a specimen of *Gleba hippopus*, Forsk., and two new Physophores for identification. *Gleba* was also collected by Mr. Agassiz in the cruise of the "Blake" along our eastern mine the genus, it is hardly enough for the species. The nectocalyx resembles closely that of *G. aurantiaca*, Vogt.*

Although *Galeolaria* is not recognized by some naturalists as a distinct genus from *Diphyes*, the form of the nectocalices, the course of the gastrovascular tubes, and especially the flap-like appendages to the inferior (posterior) swimming-bell, are so characteristic that it is here looked upon as a distinct genus.

HYDROIDA.

Halitiara formosa, gen. nov. et sp.

Plate IV. Fig. 2.

The young of a new Tubularian medusa was taken by us at the Tortugas. Generic characteristics are as follows : —

The bell is tall with a small apical projection. Chymiferous tubes, four in number, simple, broad, without lateral glands. There are four long tentacles which correspond with the radial tubes, between each pair of which are three small tentacles. Otocysts wanting.

H. formosa, sp. nov.

The bell is tall, its height being double the diameter. At its apex it bears a slight apical protuberance. The surface of the bell is smooth, and its wall thin and transparent. The proboscis (manubrium) is unpedunculated, and hangs down about one third the depth of the bell cavity. The basal portion is filled with spherical cells, which are probably ova. The lips are smooth and without appendages.

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coast in the summer of 1880. Leuckart (Siphon. von Nizza, p. 33, note 1) speaks of the same genus from the coast of Greenland. *Abyla*, *Halistemma*, and *Apolemia* have not yet been taken in our waters. There is in the collection of the U. S. Fish Commission for 1881 a mutilated fragment of the stem of a Physophore, which may have belonged to an *Apolemia*, and a new genus, *Haliphyta*, which is elsewhere described.

* The choice between the two generic names *Galeolaria* and *Suculeolaria* to designate this medusa is purely arbitrary. Lesueur gave the former to the anterior, the latter to the posterior nectocalyx of the same Diphyid. Vogt named the first complete form of this medusa *Epibulia aurantiaca* (later also *Galeolaria aurantiaca*). *Epibulia* must give place to either of the two previous names of Lesueur. The specific name, *filiformis*, Delle Chiaje, adopted by Leuckart (*Galeolaria filiformis*), although the oldest, is derived from a wrong identification. The specific name *quadrivalvis* adopted by Gegenbaur, Sars, Keferstein, and Ehlers, with others, from Lesueur and Blainville (Actin. Zoöl. Atl., VI. 6), has more in its favor, but the fragment to which it is applied by Lesueur cannot be distinguished from those other bells which bear the names *biacuta* and *minuta*. The oldest specific name applied to a *Galeolaria* the use of which leaves me no doubt of the animal intended, is that of *aurantiaca* by Vogt. To choose between it and *quadrivalvis* is very difficult.

At the extremity of each chymiferous tube on the bell margin springs a long tentacle, which is commonly carried tightly coiled about the tentacular bulb. On the bell margin, between each pair of long tentacles, are three short tentacular appendages, which are generally more or less coiled around their bases, and are carried upright, as shown in the figure. There are no otocysts. The coloration of the genus was not observed.

Tiaropsis diademata, Agassiz.

Plate VII. Figs. 13 14.

A larval stage of this medusa, younger than any *Tiaropsis* yet figured, was found by us at the Tortugas. The youngest *Tiaropsis* described by A. Agassiz * has a deeper bell and more tentacles, but in other respects seems the same.

Halicalyx tenuis, gen. et sp. nov.

Plate VII. Fig. 15.

In January, 1878, A. Agassiz found at Key West a hydroid medusa with the following characteristics.

Bell low, hemispherical, with thick walls and smooth surface. Apex of the bell destitute of protuberance. The chymiferous tubes are four in number, and from along their course in the bell hang dendritic ovaries. Through all the windings of the sexual glands there runs a bright crimson stripe, which has the appearance of being jointed.

The tentacles are twelve in number, and are carried elevated or stiffly extended at right angles to the axis of the bell. They are thickly ribbed along their whole length with lasso-cells, and enlarged at the extremity into a knob. At the base of each tentacle there is an otocyst containing a single otolith.

The proboscis is short, extending barely to the bell opening, and is without peduncle. The mouth is rectangular, and with short lips, which are sometimes turned backwards and reversed over the outer walls of the stomach.

Aglaura vitrea, sp. nov.

Plate VII. Fig. 10.

A new *Aglaura* was found by us at the Tortugas. The shape of the bell resembles that of *Trachynema*, with which the medusa is easily confounded.

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* North American Acalephæ, pp. 69, 70; Illust. Cat. Mus. Comp. Zoöl., II.; Proc. Bost. Soc. Nat. Hist., IX. p. 93. See also Morch, Beskriv. af Groenland; and Agassiz, *op. cit.;* also Mem. Am. Acad., IV. p. 289.

There is this marked difference between *Aglaura* and *Trachynema.* In *Aglaura* the sexual glands hang from the distal end of the peduncle which bears the stomach, while in *Trachynema* they are suspended from the upper part of the bell cavity.

The bell of *Aglaura* is high, cup-shaped, and without apical projection. The walls are thin, rigid and transparent. There are eight simple, narrow, chymiferous tubes. The velum is very muscular, and it is mainly by its efforts that the medusa is propelled through the water.

The proboscis is pedunculated, and bears the eight sausage-like ovaries near its point of division into peduncle and stomach. The upper part of the stomach is spherical in shape, and through its walls the half-digested food can be easily seen. Its mouth is formed by labial walls, in which are imbedded lasso-cells. Many patches of red pigment are present in the lips and the walls of the stomach.

The tentacles are very numerous, long, and flexible, and are generally broken off near their bases, leaving stiff projecting stumps, as in *Trachynema digitale* A. Ag. Several specimens were captured which carried the flexible tentacles unbroken, but for the most part these bodies presented the appearance shown in the figure.

There are eight otocysts, alternating in position with the chymiferous tubes. Each otocyst contains a single otolith. The ovaries are cream-colored. The development of the egg is unknown.

A. vitrea resembles very closely the *A. hemistoma*, Peron et Lesueur, found so commonly in the Atlantic Ocean and Mediterranean Sea. It has, however, no apical projection to the bell, and the umbrella is half-egg-shaped. The form of the bell is so variable that it may eventually be found to be identical with the well-known *A. hemistoma.*

Glossocodon tenuirostris (sp. Agassiz).

Plate VII. Figs. 1-9.

In 1857 McCrady* gave a description of a new species of *Liriope*, to which he affixed the name *Liriope scutigera.* L. Agassiz † in 1862 mentions from Key West, Florida, another species, *L. tenuirostris*, which he says has a more slender proboscis than *L. scutigera.* A. Agassiz ‡ gives a figure of a *Liriope*, which he identifies with *L. scutigera*, and mentions the form *L. tenuirostris*, from Florida, without description. The figure of *L. scutigera* by A. Agassiz has slighter ovaries than those mentioned in McCrady's description, and has not the interradial tentacles ("four short" tentacles) spoken of by the last author. The figure, however, was but a sketch, and the medusa from which it was made is probably correctly referred to *L. scutigera*, McCr. Haeckel takes exception to this identification, and makes it a new species of *Liriope*, to which he assigns the name *L. conirostris*. From the fact that no mention is made by McCrady of "blinde Centripetal-canäle," Haeckel refers *L. scutigera*, McCr. to his own genus *Liriantha*.

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* Gymnophthalmata of Charleston Harbor. Proc. Ell. Soc. Nat. Hist., 1857.

† Contributions to the Natural History of the United States, IV.

‡ *Op. cit.*, p. 60.

In my work on the medusæ of Narragansett Bay a very poor figure of what I regard the same as *L. scutigera* is given, as taken at Newport, R. I.*

Fritz Müller † has published an anatomy and development of *L. Catharinensis*, F. M., which differs from the medusa about to be described only in the want of the blindly ending centripetal canals, which lie between the radial tubes. In all details the likeness is very close. It also is placed in the genus *Liriantha*, Haeck., by Haeckel, ‡ on account of the want of these centripetal structures. In the use of the generic designations *Glossoconus* and *Glossocodon* in the "System der Medusen" of the latter author, the medusa which is here described would be placed under the latter rather than the former genus; yet in the figures of the oldest stage found there will be noticed two kinds of tentacles on the bell margin, whereas *Glossocodon* has but one kind, viz. tentacles of the radial tubes. In *Glossoconus* there are two kinds of tentacles on the bell margin, as well as blindly ending centripetal canals between each pair of radial tubes. In younger stages, however, according to Haeckel, there is only one such canal between every pair of tentacular vessels.

Many specimens § of the genus *Glossocodon*, which is strictly speaking in the *Glossoconus* stage described by Haeckel, were found at the Tortugas. It has the ovaries well developed and to every appearance is sexually mature. No specimen was taken with less than eight tentacles, and consequently if on further study it should be found to drop certain tentacular bodies on the bell rim midway between the tentacular vessels (radial tubes), it should be referred to *Glossocodon*. In its present condition it belongs to the genus *Glossoconus*, Haeckel.

The species differs from *Liriope scutigera*, McCr. in having but one kind of otocyst, and in possessing the blindly ending centripetal tubes (*d*, Pl. VII. fig. 1). The figure of *L. scutigera*, A. Ag., has four long tentacles, and ovaries of a different form, while there are no centripetal tubes. It resembles *L. Catharinensis*, F. Müll., in every respect except that the centripetal canals are wanting in Müller's figure and description. In L. Agassiz's short description of *L. tenuirostris*, there is nothing to eliminate our species. Instead of introducing a new name, his specific designation has been adopted.

The adult *Glossocodon* has a deep, almost spherical bell (Pl. VII. fig. 1). The bell walls are thick, especially at the apex, although there is no apical protuberance. The surface is smooth; its walls very transparent. The bell cavity, when seen in profile, is rectangular. The floor opposite the bell entrance is almost flat, and not concave, as in many other medusæ. This characteristic in the shape of the bell cavity is noticeable even in young stages. It differs in this respect from the figure given by Fritz Müller of *Liriope Catharinensis.*

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* Studies of the Jelly-fishes of Narragansett Bay. Bull. Mus. Comp. Zoöl., VIII. 8.

† Polypen und Quallen von S. Catharina. Arch. f. Naturg., 1859, pp. 310–321, Taf. XI. figs. 1–25.

‡ Das System der Medusen, I. 1, p. 287.

§ The adult and young of this medusa figured on Pl. VII. figs. 1–9, were drawn from nature by A. Agassiz.

Upon the walls of the bell cavity there are found two kinds of chymiferous tubes. Four of these vessels are radially arranged, and pass from a circular tube about the bell opening to a highly flexible proboscis, along the sides of which they extend, opening eventually into the stomach at the extremity of the proboscis. These tubes are narrow, unbranched, and without lateral appendages. The sexual glands hang from the radial tubes, extending about two thirds their length, in the inner surface of the bell. They end at the point where the radial vessels bend at right angles to the outer walls of the bell. Midway between each pair of radial tubes, arising from the bell margin and extending in the bell walls about one third the height of the cavity, there is a single blindly ending centripetal canal (*d*), characteristic of the adult. These tubes (*l*) are four * in number, and do not bear ovaries.

The largest and most important appendage to the bell is the long, slender, and highly flexible manubrium or proboscis. It springs from the centre of the floor of the bell cavity, and, when the jelly-fish is quiet in the water, hangs far outside the vail. At other times it is so contracted that its termination barely projects beyond the bell margin. It consists of two parts, a hyaline base, which resembles in character the bell walls, and a distal pink-colored stomach with a terminal mouth. The only structures which can be recognized in the peduncle of the proboscis are the four chymiferous tubes just below the surface. These are extensions of the radial chymiferous tubes, which have been described above. These tubes open into the stomach near the distal end of the proboscis. The distal end of the peduncle of the proboscis is continued inside the stomach into a conical projection or tongue. In fig. 9 we have a view of the distal end of the manubrium with the walls of the stomach reversed to show the projecting tongue.

The stomach of *Glossocodon* is a bag-shaped structure with pinkish walls, situated at the distal extremity of the manubrium. When the mouth is expanded, as in the figure, it assumes a quadrangular shape. The edges of the lips are lined with clusters of lasso-cells (fig. 9) arranged in bundles equidistantly arranged around the border of the mouth. Similar cells are described in *L. Catharinensis* by Fritz Müller. The stomach walls are capable of great expansion, and the mouth opening is very large. Oftentimes the lips are turned back, leaving the projecting tongue very prominent. When not feeding, or when alarmed, the lips are pressed closely together, concealing the tongue and closing the entrance into the stomach. The stomach walls are not transparent, but contain many small pigment-dots and minute lasso-cells, irregularly imbedded in their substance.

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* In the only complete drawing of the adult which we have, there is only a single centripetal canal between each pair of ovaries. There are probably three such structures instead of one in that position. This can be seen in sketches of a portion of the bell margin which I have not copied. The medial of these three canals, which is that figured in fig. 1, is larger than the two lateral, which are little more than slight protuberances.

There are two forms of tentacular appendages found on the bell margin. At the end of each radial tube there is a tentacle which is long, hollow, and very flexible. The surface of each such tentacle is covered with lasso-cells arranged in rings surrounding the appendage. We thus have along its whole length annulations of lasso-cells, alternating with smooth depressions. The correlation between the stomach and tentacles is very well shown in this *Glossocodon*. The voracity of *Liriope* is mentioned by McCrady,* and in this animal it is equally great. The abundant lasso-cells upon the tentacles and the lips are but necessary to capture living food to satisfy an enormous appetite.

In addition to the long tentacles there are four others likewise springing from the bell rim. In the adult *Glossocodon* these appendages are wanting, and in the oldest form which we found they were reduced to the mere "stump" of a tentacle. We have, however, no drawing of our jelly-fish in which they are not represented. Each of these appendages is situated midway on the bell margin, between two long tentacles. In the adult stage (fig. 1) they are club-shaped bodies, united to the bell by means of a slender peduncle, and are carried stiffly erect. They are solid, inflexible, and on their outer convex surface there are clusters of lasso-cells arranged with regularity. At the position of union of the bell walls and the peduncle of this appendage there is a slight spur or solid extension of the base on the outer surface of the bell, extending upwards a short distance on the bell walls.

The adult *Glossocodon* has eight otocysts, which are arranged on the outer edge of the bell margin near the points from which the tentacles, long and short, arise. Those which are found near the tentacular bulbs of the long tentacles are placed at one side of the tentacle, and not at its very base. The other set of otocysts are placed in the immediate vicinity of the origin of the pedicle which bears the solid tentacle. There is but one kind † of otocyst found on the bell margin, and it is a simple sac containing a single otolith. The sexual organs hang like heart-shaped pouches from the four radial tubes. They are sometimes so inflated that the walls of adjoining glands almost touch. Their size and shape vary greatly, depending solely on the maturity of the ova. Their color is white and sometimes pink. Male and female glands may be found later to be distinguished by a difference in color, but little is known of the difference of the sexes in *Glossocodon*.

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* McCrady saw *L. scutigera* with its tentacles and lips seize a small fish "thrice as large as itself" (*op. cit.*, p. 209).

† According to McCrady there are two kinds in *L. scutigera* (*op. cit.*, p. 208).

The youngest larva of *Glossocodon* which we have found was approximately in the same stage as that figured in fig. 18 of Fritz Müller's paper. It resembles closely the larva which Haeckel * figures, Pl. III. fig. 35, as the young of *G. eurybia*. In Haeckel's representation of this stage, no chymiferous tubes are to be found. The bell in his figure is also more spherical, and the profile of the bell cavity lacks the rectangular shape which our youngest larva had. The bell is low, disk-shaped, transparent, and has a smooth outer surface. The bell cavity has a cylindrical shape, its walls following closely the outer surface of the bell. The bell walls are of about uniform thickness throughout. There are four radial tubes passing from the bell margin to the centre of the upper floor of the bell cavity. They bear no sexual pouches.

The proboscis is the least developed of all the appendages to the bell in the youngest larva which was captured. It has the form of a simple, raised wall of rectangular shape, arising from the upper floor of the bell cavity. There is in it no division into stomach and peduncle. The lips are simple, and are destitute of the clusters of lasso-cells found in the adult.

There is only one kind of tentacular appendages to the bell margin in this larva, and these are the club-like bodies situated midway between the tentacular or radial tubes. The long flexible tentacles at the end of the radial vessels have not yet begun to form. Those tentacular bodies which are present are solid and are carried stiffly elevated at the side of the bell. Their length is about that of the radius of the bell, and their diameter near their distal extremity is very much greater than at the attachment to the bell rim. The inner concave side of the appendage is smooth and without lasso-cells; the outer, convex surface bears many clusters of cells arranged in bundles in a series. These bodies are especially numerous near the terminal end of the tentacle. On the outer surface of the appendage, near its junction with the bell margin, a small conical tooth is developed. A similar spur is not to be found in the published figures of *G. eurybia* or *L. Catharinensis*. These tentacles are represented in the adult by bodies (*c*) of reduced size, which are said eventually to disappear in *Glossocodon*.†

While these bodies are the only tentacles found upon the bell margin, they are not the only appendages of a tentacular nature which the youngest *Glossocodon* has. A second kind of appendage, also embryonic, is situated on the outer surface of the bell walls. At right angles to the sides of the bell, in the same spheromere in which the radial tubes lie, there spring four solid appendages, which are true tentacles. At its distal end each of these tentacles is enlarged, and bears many lasso-cells; but of its minute anatomy and the arrangement of cells at that point nothing was observed. Its base of attachment is about one third the distance between bell margin and apex, and is connected by a rib (*b*) with the bell rim. This rib is probably a solid body and not a tube, and is strictly homologous to a like structure in *Cunina discoides*, Fewkes. It lies on the outer surface of the bell, while the radial tube follows the inner or the bounding wall of the bell cavity. There are *four* otocysts, each closely resembling the otocyst of the adult in the larval form which has just been described. Each otocyst is placed on the bell margin at the point of attachment of the solid tentacle.

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* Die Familie der Rüsselquallen, 1865, Pl. III. fig. 35, pp. 67, 68. Called by Haeckel the fourth stage (*Eurybia-like larva*).

† Haeckel, *op. cit.*

The next oldest larva to that already described is one which, together with the following (figs. 3, 4), may be referred to the "*fifth period*" (Haeckel) of *G. eurybia.* It corresponds in some respects with fig. 20 in Fritz Müller's account. In this larval stage (fig. 3) the most marked addition to the former is the growth of tentacular bodies on the bell margin midway between the solid tentacles (*c*). They lie near the union of the radial vessels with the circular tube, and are the beginnings of the long flexible tentacles. They are in a larva even as young as fig. 3 banded with the lasso-cells characteristic of the adult, which seems to be true in a larva of the same age figured by Haeckel (Pl. III. fig. 37). Fritz Müller represents two of these appendages as formed prior to the remainder. The stage of such a larva may be a little younger than my fig. 3, in which all these bodies, four in number, were equally developed. The most important difference between the two figures (figs. 3, 4) which are given to represent the *fifth period* is the result of the growth of the proboscis, which even in this larva is differentiated into a basal peduncle and a terminal stomach. The larva has still only four otocysts.

Haeckel's account of the development of *G. eurybia* closes with the *fifth period.* Between that and the adult he has given no figures of intermediate stages. Fritz Müller's paper, however, has one more stage intermediate between these two, in which there appear to be ten otocysts on the bell margin intermediate between the radial canals, before the organs corresponding to the tentacles (*a*) are dropped. In the present species the otocysts of the long tentacles do not develop before the complete loss of the bodies (*c*).

Fig. 5 represents a larva in the *sixth period* of its development. This larva differs from that last represented (fig. 4) in the growth of the long tentacle on the bell margin and the total loss of the tentacle (*a*). It is to be noticed, however, that there are still but four otocysts, and that these bodies lie at the bases of the solid marginal tentacles (*c*). A larva still older than this, but undoubtedly to be placed in the same period (*sixth period*) is the first in the series having eight otocysts. The four sense bodies additional to those at the base of the marginal solid tentacles appear at the base of the long tentacles for the first time in a larva represented in fig. 6. This larva has assumed the form of the adult in many particulars, one of the most prominent of which is the enormous development of the proboscis. The sexual glands have not yet begun to form, or at least are not represented. In a larval form which approaches very closely the adult, the sexual glands are well developed and crowded with ova. Such a larva is figured in fig. 7, which represents the *Glossocodon* as seen from the aboral pole. In the adult the only representative which can be found of the embryonic structure (*b*) is a tooth or spur which is represented in fig. 8.*

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* It will be seen, if my account of the development of *Glossocodon* be compared with Fritz Müller's (*op. cit.*), that, while according to my account the peduncle (*Stiel*) of the stomach appears long before the secondly formed otocysts, he represents them both as developing at about the same time. It will also be seen that the four secondary otocysts follow instead of precede the appearance of the long tentacles. According to him the otocysts, as the long tentacles, appear in pairs situated diametrically opposite on the bell rim. No observations were made by us on this point.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Ocyroë crystallina* (young).
" 2. The same, with oral lobes expanded.
" 3. A single oral lobe extended.
" 4. Position assumed by the oral lobe.
" 5. View of oral lobe from the aboral pole (expanded).
" 6. The same contracted.
" 7. *Cassiopea frondosa* in natural position.
" 8. Young of the same (aboral view).
" 9 *a*. Side view of young *Cassiopea.*
" 9 *b*. Older larva of the same.
" 10. *Cassiopea frondosa* (aboral view).
" 11. The same (oral view).
" 12. Marginal sense body of the same (aboral side).
" 13. The same (oral side).
" 14. Double marginal sense body of *C. frondosa* (monstrosity).
" 15. The same (aboral view).
" 16. Marginal sense body with two ocelli (monstrosity).
" 17. Extremity of the oral arms of *Cassiopea.*
" 18. Mouths and pouches of the same.
" 19. Oral appendage from upper side.

a.	Auricles.
b.	Bifurcation of the lateral tubes.
c.	Primary tubes from the base of the funnel.
c e.	Secondary tubes, branches of the primary.
d.	Oral branches.
e.	Radial stripes.
e'.	Intermediate spaces between the radial stripes.
f.	Marginal zone.
h.	Hood.
i.	Oral disk.
i.	Otocyst.
k.	Stomach.
l.	Lips.
m.	Mouth.
o.	External sexual opening.

p.	Chymiferous reservoirs.
p'.	Oral tentacles.
t.	Auricular tubes.
t'.	Velar lappets.
t t.	Ocular lappets.
l t.	Lateral tubes.
oc.	Ocellus.
os.	Otocyst style.
ot.	Otoliths.
s t.	Lobular tubes.
u.	Central zone.

PLATE II.

Fig. 1. *Cassiopea frondosa* (aboral view).
" 2. The same (oral view).
" 3. *Linerges Mercurius* (side view). The marginal lobes are infolded.
" 4. The same. The marginal lobes are extended and the crescentic form of the ovaries is shown.
" 5. *L. Mercurius* (aboral view).

PLATE III.

Fig. 1. Portion of the oral surface of *C. frondosa.*
" 2. Peripheral extremity of a canal lying in the central cavity between two ovaries. Showing also the opening (*b*) leading from it into the chymiferous system of the oral arms.
" 3. Oral cylinder cut off from the bell, so as to expose its cavity.
" 4, 5. Life-size figures of *L. Mercurius* in attitudes assumed while swimming.
" 6. Section cut through the cavity which lies above the stomach of *L. Mercurius.* One half this sinus is drawn in longitudinal plane, i. e. section cut in the direction of the axis of the medusa.
" 7. View of the opening by which this cavity communicates with the stomach.
" 8. The same opening shown in an ephyra in order to illustrate its relations to the remaining structures of the same.
" 9. *Cassiopea frondosa.*
" 10. The same (position assumed in floating).
" 11. Ovary (shrunken) of *L. Mercurius.*
" 12. Portion of the inner bell wall of the same medusa.
" 13. *L. Mercurius* from oral side.

a. Circular orifice, centrally placed, communicating between the stomach and the cavity situated above it.
b. Opening leading from the cavity of the oral cylinder into the chymiferous vessels of the arms.
c. Cavity above the stomach.

c.	Sac (subumbral).
f.	Margin of the bell.
gf.	Gastral filaments.
h.	Patches of pigment.
i.	Substance of the bell.
k.	Pouches.
ls.	Row of pigment-spots on the walls of the stomach.
o.	Ovary.
p.	Chymiferous reservoirs.
p'.	Oral tentacles.
ot.	Otocyst.
so.	Sexual openings through which the ova are discharged.

PLATE IV.

Fig. 1. "Sense area" (*Beroë ovata*).
" 2. *Halitiara formosa.*
" 3. Ephyra (?) of *Linerges Mercurius.* (Quadrant of disk from below.)
" 4. Ephyra (*L. Mercurius*) younger than fig. 3.
" 5. Ovaries and subumbral pouches (*L. Mercurius*).
" 6. Subumbral pouch (*L. Mercurius* adult).
" 7, 8, 9, 10, 11, 12. Eggs and stages of their segmentation (*L. Mercurius*).
" 13. Planula (*L. Mercurius*).
" 14. Ephyra (?), (*L. Mercurius*).
" 15. Ephyra more developed than fig. 3. (Octant.)
" 16. Marginal sense body of ephyra (*L. Mercurius*).
" 17. The same (side view).
" 18, 19. Marginal sense body (*L. Mercurius* adult).
" 20. Gastral filaments (*L. Mercurius*).
" 21. Tentacle and bell margin (*L. Mercurius*).
" 22. Single marginal tentacle (*L. Mercurius*).

PLATE V.

Fig. 1. *Stephanomia Atlantica.*
" 2. *Agalmopsis fragile.*
" 3. *Athorybia formosa.*
" 4. *A. formosa.* (From above.)
" 5. *Agalma papillosum.*
" 6. *A. papillosum.* (From above.)

a.	Float.
a a.	Air-sac.
b.	Axis.
c.	Covering-scale.
d, d', d''.	Tastern.
e.	Filament of the taster.

fs.	Female bells.
g.	Papillæ.
h.	Somatocyst.
h n.	Recesses opening into bell cavity.
j.	Undeveloped tentacular knobs.
k.	Adult tentacular knobs.
l.	Lasso-cells.
m s.	Male bells.
n.	Nectocalyces.
o.	Ocellus.
p.	Polypite.
r.	Chymiferous tubes.
t.	Tentacle.
u.	Undeveloped nectocalyces.
w.	Wimperwulst. Peduncle of polypite.
x.	Structure of unknown homology.

In figure 1 the bell margins are too prominent, and the spiral lines in which the openings into the cavities of the nectocalyces lie are imperfectly shown.

PLATE VI.

Fig. 1. *Rhizophysa gracilis,* sp. nov.
" 2. Float (*R. gracilis*).
" 3. Sexual organs (*R. gracilis*).
" 4. Polypite and proximal part of the tentacle (*R. gracilis*).
" 5. First kind of tentacular knob (*R. gracilis*).
" 6. Second kind of tentacular knob (*R. gracilis*).
" 7. First kind of tentacular knob (*Athorybia formosa*).
" 8. The same from one side.
" 9. Second kind of tentacular knob (*A. formosa*).
" 10. The same from one side.
" 11. Male bells (*A. formosa*).
" 12. Female bells (*A. formosa*).
" 13. Taster (*A. formosa*).
" 14. Covering-scale (*A. formosa*).
" 15. Tentacular knob of *Agalma papillosum.*
" 16. Taster and sexual bells of *Agalmopsis fragile.*
" 17. Tentacular knob (*Ag. fragile*).
" 18. Tentacular knob of *Stephanomia Atlantica.*
" 19. The same, uncoiled.
" 20. Polypite (*S. Atlantica*).
" 21. Tentacular knob (*S. Atlantica*).
" 22. Polypite (*S. Atlantica*).
" 23. Polypite (*Ag. fragile*).
" 24. Male bell (*Ag. fragile*).
" 25. Cluster of male bells (*Ag. fragile*).

Fig. 26. Nectocalyx (*Galeolaria aurantiaca*).
" 27. Papilla from the nectocalyx (*A. papillosum*).

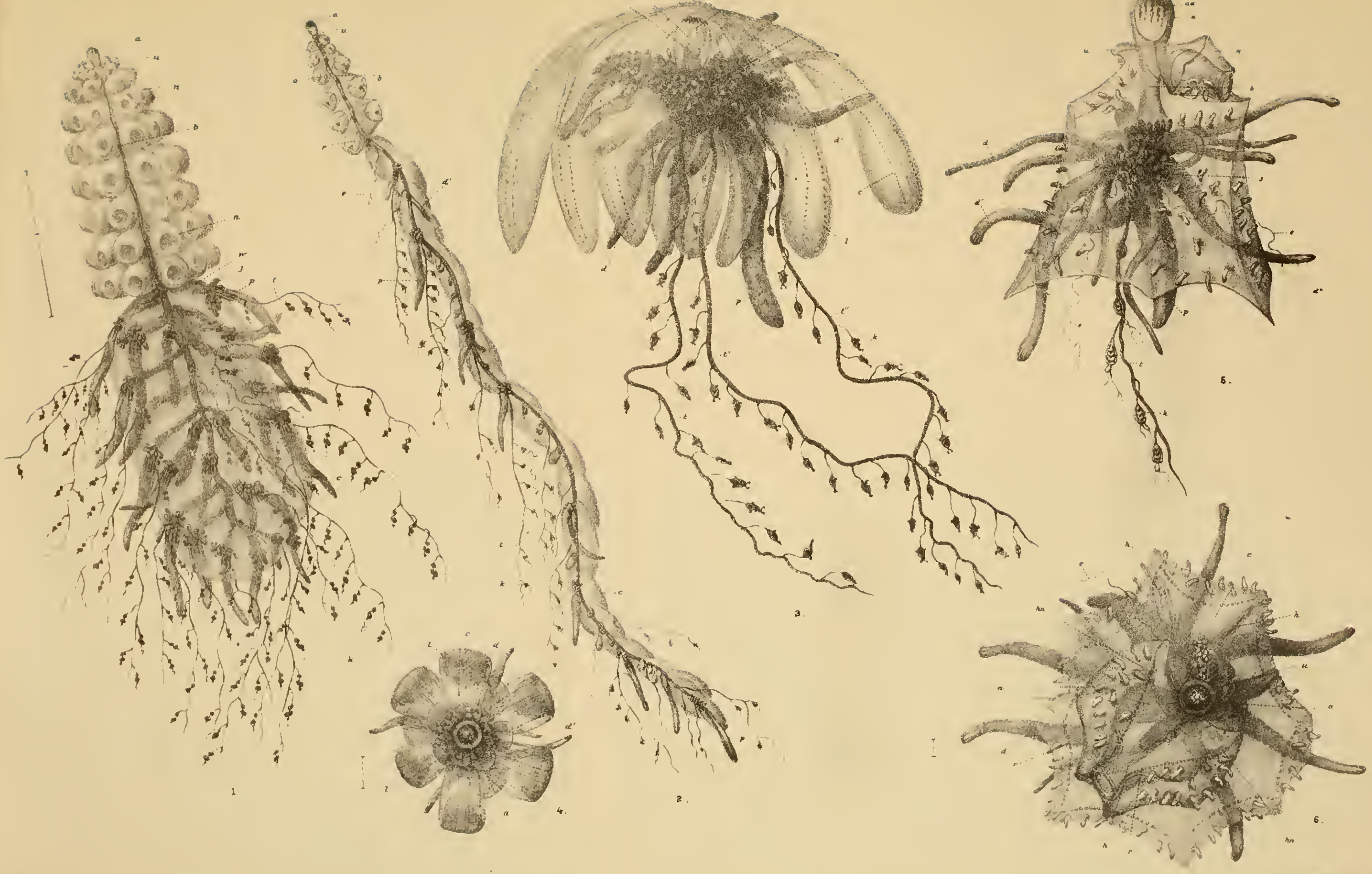
a. Apex.
b. Lateral filaments.
c. Terminal vesicle.
d. Sacculus.
e. Appendage to the float (undeveloped polypite ?).
f. Circular plates.
g. Thickened walls of the air-sac.
p. Polypite.
s. Sexual organs.

PLATE VII.

Fig. 1. *Glossocodon tenuirostris.*
" 2. Larva of the same (fourth period, Haeckel).
" 3. The same more developed (fifth period, Haeckel).
" 4. Larva in fifth period.
" 5. Larva in sixth period.
" 6. Same, more developed.
" 7. Fig. 1 from aboral pole.
" 8. Base of the adult tentacle.
" 9. Everted stomach walls and protruded gastrostyle.
" 10. *Aglaura vitrea.*
" 11. *Eucharis multicornis* (one half body of the young).
" 12. Same at right angles to fig. 11.
" 13. *Tiaropsis diademata* (young).
" 14. Quadrant of the same (oral view).
" 15. *Halicalyx tenuis* (only four of the twelve marginal tentacles are drawn).
" 16. *Staurophora laciniata.*
" 17. Tentacular knobs and "spur" of the same.

a. Embryonic tentacles from bell walls.
b. Ribs connecting the embryonic tentacles with the bell rim.
c. Club-shaped tentacular bodies.
e. Tentacular spur.
f. Auricle.

Cambridge, April 1, 1882.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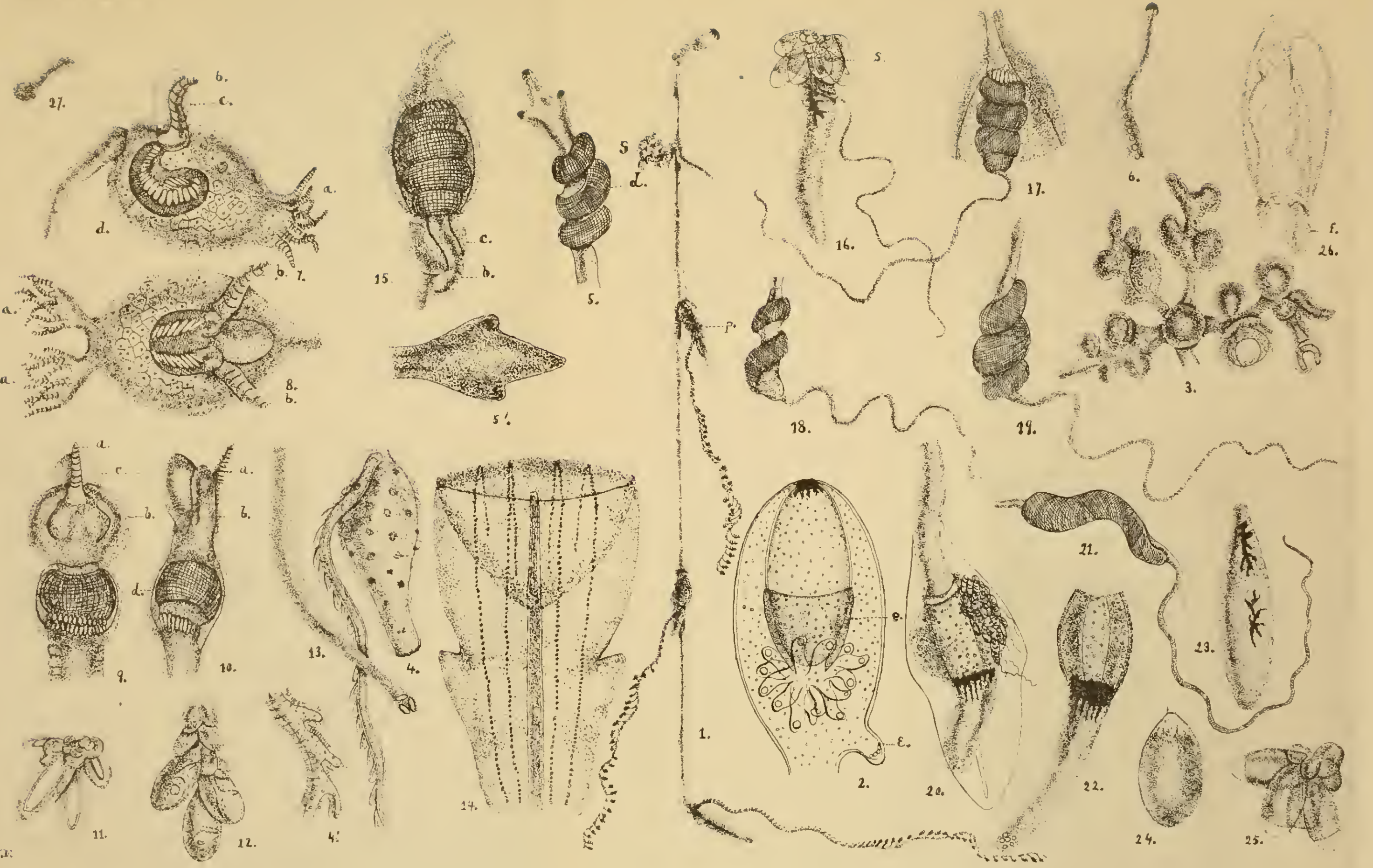
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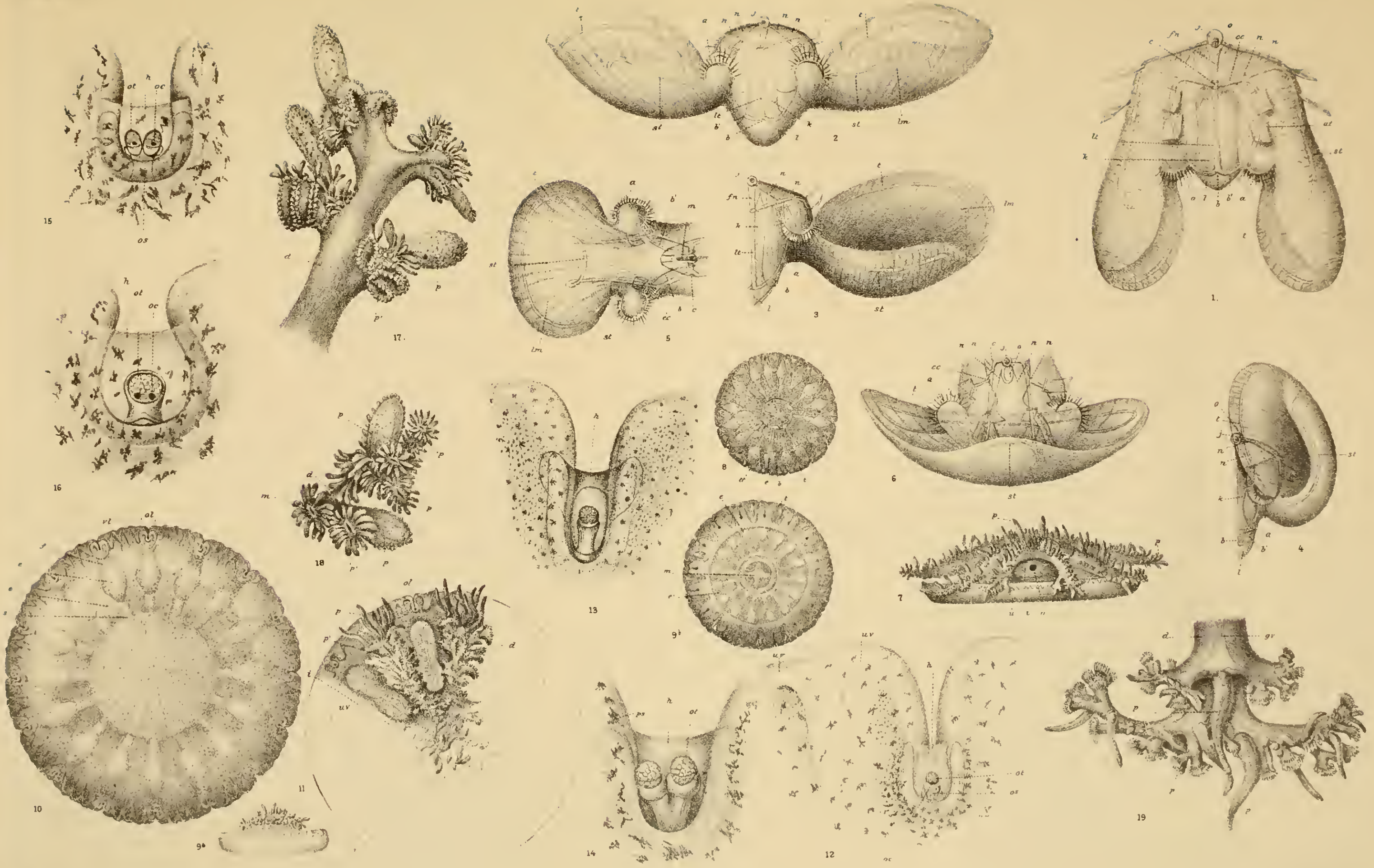
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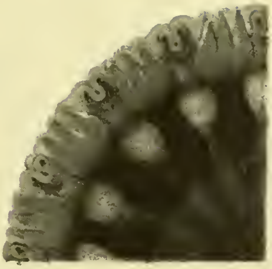

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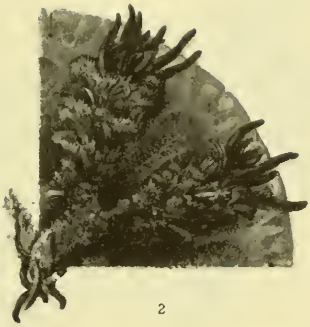

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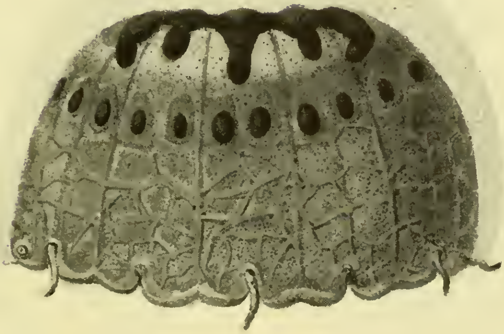

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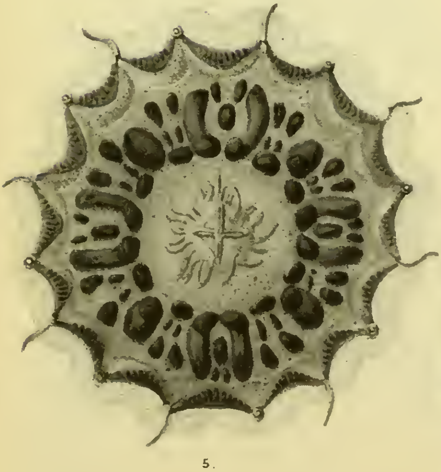

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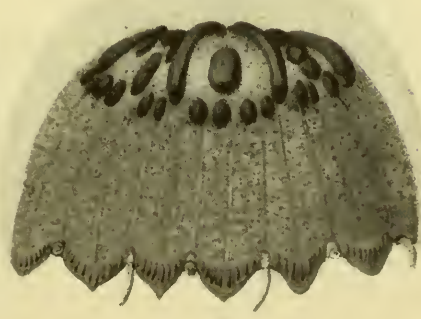

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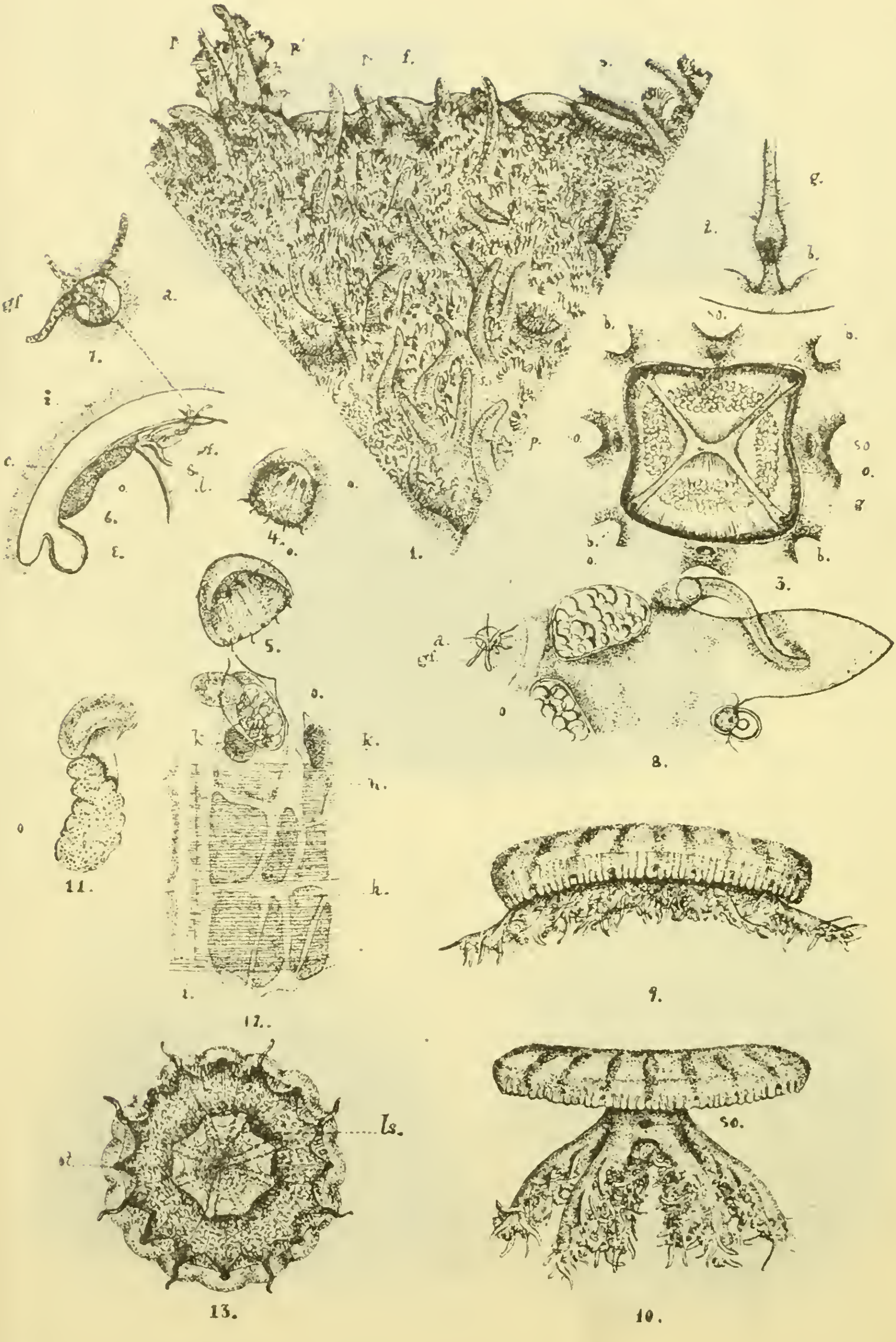
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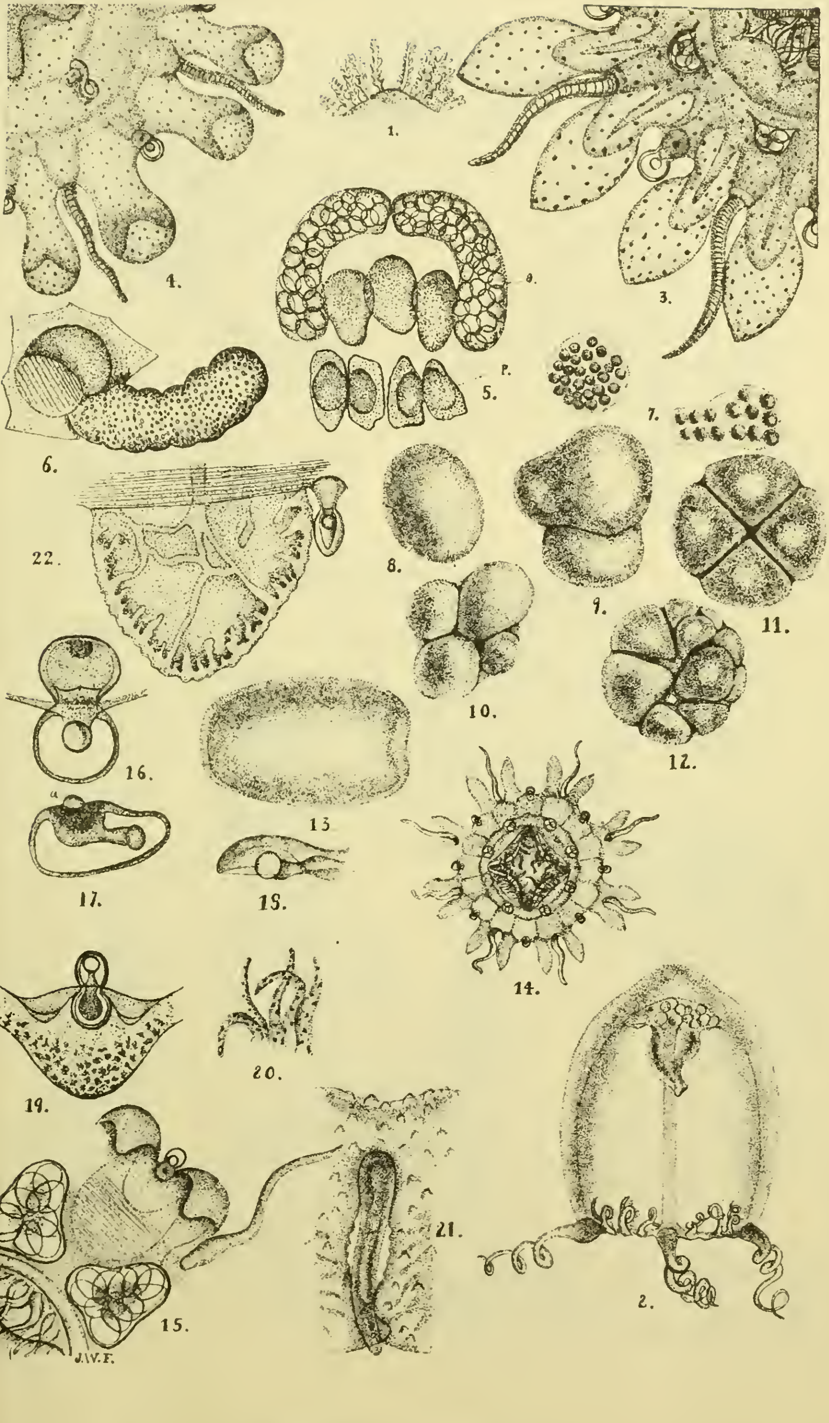
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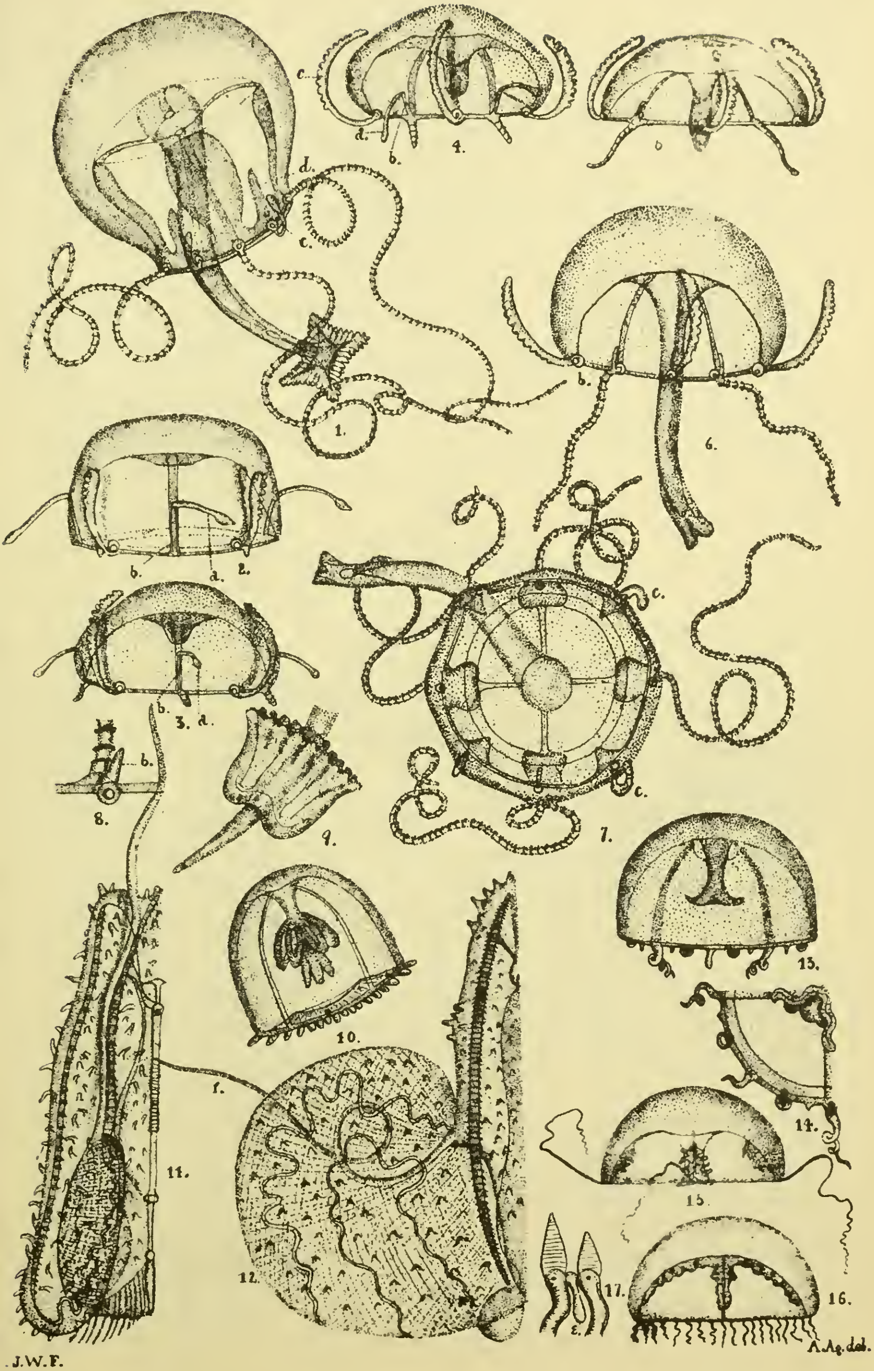
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No. 8. — *On the Acalephæ of the East Coast of New England.* By J. Walter Fewkes.

The observations recorded in the following pages are placed under two titles. The first subject, " Medusæ from Newport " relates to jelly-fishes taken at Newport, R. I., in the summer of 1881.* Under the second, "Acalephæ collected by the U. S. Fish Commission, &c.," will be found descriptions of jelly-fishes taken by them off the New England coast in 1880 and 1881.†

I. Medusæ from Newport.

CTENOPHORA.

Development of the Chymiferous Tubes in Mnemiopsis Leidyi, A. Ag.

Figs. 1-9.

In the development and union of the chymiferous tubes, the larval stages of *Mnemiopsis* differ radically from those of the closely related genus *Bolina*, whose embryology is described and figured by Mr. A. Agassiz.‡ In *Bolina*, according to the author last mentioned, those ambulacral tubes which are situated nearest the tentacles are the first to unite, "forming thus the first connected loop enclosing in the adult *Bolina* the complicated winding tubes of the short pair of chymiferous canals of the actinal lobes."

The first pair of these tubes to unite in the young *Mnemiopsis* are not the vessels which lie adjacent to the tentacles, but those placed in the body walls between the tentacular rows of combs. It therefore appears, in other words, that the chymiferous tubes which are the last to join in *Bolina*, are first to unite in the closely allied *Mnemiopsis*.

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* I am indebted to Mr. Agassiz for facilities to carry on this portion of the work in his private laboratory at Newport, R. I.

† These medusæ have been placed in my hands for study through the kindness of Prof. Verrill. I take this opportunity to express my indebtedness to him for this and other favors.

‡ North American Acalephæ, p. 17; also Mem. Amer. Acad., Vol. X. No. III. Mr. Agassiz has pointed out that the sequence in the union of the ambulacral tubes of *Bolina* is exceptional.

The successive stages in the growth of the young *Mnemiopsis* are as follows. In the youngest larva which was taken we recognize most of the organs of the adult. The lateral tubes (*l*), which originate as simple blind sacs, end in the neighborhood of the lips without bifurcation. The eight remaining vessels, situated meridionally just below the surface beneath the rows of "combs," resemble each other in size and have about the same length, each also ending blindly in the body walls.* Fig. 1 represents this larva, drawn in a plane passing through the tentacles and the otocyst. The two auricular vessels (*a t*) are seen to lie adjacent to the tentacles, one on either side, while the lobular tubes (*l t*) are situated in the segments between them.

A clearer conception of the relationship of the chymiferous tubes to each other may be obtained by a consultation of the following figure (1 *a*), taken from the actinal pole. In no other way can the origin of the chymiferous vessels from the funnel be shown to such advantage as by a drawing made in this way. The eight meridional tubes spring in pairs from a vessel (*c*) which arises from the base of the funnel (*f*). From the point of bifurcation also, there originates a tentacular tube (*t t*), which passes to the tentacular sac. This tube exists in the youngest larva studied, as a very broad vessel, and in subsequent growth it becomes more and more slender and tubelike, as shown in following figures. The lateral tubes (*l*) originate independently of all the others, as short diverticula from the base of the funnel.

Fig. 2 represents, in the same plane as the above, a larval *Mnemiopsis* somewhat older than the last. The most marked difference between the vessels of the two is produced by a growth of the lobular vessels, which have lengthened more than the auricular, and now extend about half-way down the length of the body. In other respects they are unchanged. The lateral tubes (*l*) have remained in about the same condition as in the previous stage, and have not yet bifurcated at their extremities.

In Fig. 3 the lobular vessels are represented as having extended still farther in their growth, and are rapidly approaching the oral pole of the medusa. Their extremities have even turned towards each other preparatory to a final union. The auricular tubes have also lengthened and pushed their way about two thirds the whole distance from the apical to the oral pole.

Fig. 4 represents a larva somewhat more developed than the last, in which the growth preparatory to a fusion of the lobular tubes has gone still further, so that the extremities of the lobular vessels almost touch each other. By far the most important change has taken place in the lateral tubes, which are now bifurcated at their extremities.

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* In my descriptions the lobular vessels correspond with what Mr. Agassiz calls the "long ambulacral tubes (longitudinal ambulacra)," and the auricular vessels with his "short ambulacral tubes (lateral ambulacra)." The adjectives *lobular* and *auricular* seem to me preferable to "long" and "short," to avoid confusion in a comparative study of these structures in other Ctenophores (contrast the long and short ambulacra of *Cestus* and *Ocyroë*). I have abandoned the adjective "lateral," as applied to ambulacra, in order to avoid confusion with other vessels (*l*) designated by the same name, on each side of the stomach. Between the older term "longitudinal" and the new adjective *lobular*, I have chosen the latter, as more characteristic. The nomenclature adopted seems to me to call attention to characteristic features in all genera of *Ctenophora*, as well as of *Mnemiopsis*.

The fusion of the lobular vessels appears in a larva (Fig. 5) following the last. A junction of these tubes has here been effected, forming one continuous vessel. In the same stage the auricular tubes have also pushed downward through the bell walls, but they still end blindly and without division. They also eventually fuse, and in a following stage (Fig. 6) they bend towards each other and approach in such a way as to enclose the loop of the lobular vessels, which has been already formed.

In the next figure (6 *a*) the junction of the two auricular vessels has occurred, so that a connecting loop is formed enclosing that already resulting from a fusion of the lobular vessels. It will also be noticed that the lower ends of the lateral tubes have bifurcated. Its terminal division (*l l*) is shown in the foreground of the figure. At about this stage in the growth of the Ctenophore, the lobes (*o l*), which later reach such a great size, begin to be differentiated from the body of the medusa. In Fig. 7 they have pushed themselves still more prominently into notice, and the network of lines upon their inner surface is even now well marked. Meanwhile a slight variation in the direct meridional course of the auricular tubes marks the situation of the future auricles (*a*). The two branches formed by the bifurcations at the extremity of each lateral tube have grown to such an extent that they join the auricular vessels one on each side at a point directly below the position where the lower edge of the auricles ends.

The oldest larva of *Mnemiopsis*, which I have figured, shows nearly the same disposition of vessels as one finds in the adult. Subsequent modifications in the course of these vessels consist in their deviation from the direct meridional lines, and their increase in length ; but no new junction of tubes takes place in intermediate stages between this larva and the adult *Mnemiopsis*.

DISCOPHORA.

Dactylometra quinquecirra, A. Ag.

Figs. 25-28, 38, 39.

A single specimen of this interesting Discophore was taken by me in the last summer, and from it a few new observations were made, which may add something to our imperfect knowledge of its anatomy.

The bell margin bears eight otocysts and a variable number of tentacles, which have the following arrangement. If we take the interval of bell rim between two otocysts we find appended to it a variable number of tentacles. A figure is given of such a portion in which there are eight tentacles. Of these the two tentacles adjacent the otocysts are larger than the remainder, and hang from the incisions between two marginal lappets. The remaining six tentacles are of smaller size, and are irregularly placed as regards the incisions between the marginal lobes. The tentacles have a brownish color above, and are white on the under side. The two marginal lobes adjacent the marginal sense bodies are larger and more prominent than the others. In the interval of bell margin between them there are five smaller lobes. Each lobe is leaf-shaped, pointed, and very flexible. In each lobe there ends blindly, without dendritic ramifications, a chymiferous vessel, which is a prolongation from a cavity, or system of vessels in the disk. There are four ovarian openings, each of which lies in a radius drawn from alternate marginal sense bodies. They resemble most closely similar openings in *Aurelia.* The ovaries themselves have a pink flesh-color. The ovarian filaments are well developed. The marginal sense bodies are highly characteristic. When looked at from the aboral side, in the region of the bell margin in which the otocyst lies, there is in its immediate vicinity a small pit or depression in the bell walls. This pit is identified as a "Riechgrübschen." It is commonly regarded in other medusæ as an organ of special sensation. The situation of this pit in *Dactylometra* is such that one cannot help being reminded that it may be simply the thinning out of the bell walls above the sense body in order to increase the sensitiveness of the otocyst below. The oral curtains, which are so prominent on each side of the otocyst of *Cyanea,* are wanting in *Dactylometra.* The two lappets found one on each side of the marginal sense body of *Aurelia* also fail. Two well-marked inner Riechgrübschen are found one on each side of the base of the style. The ocellus is inconspicuous or wanting. The otocysts do not differ from those of other Discophores, and are formed of a simple sac with enclosed otoliths. They have a whitish straw color, and are easily seen from the aboral side, showing through the bell walls at the bottom of the recess or pit called the outer Riechgrübschen.

HYDROIDA.

Calycidion formosum, Fewkes.

A further consideration of my former * identification of *Turritopsis nutricula,* McCrady, has convinced me that I was wrong in my determination of this medusa. The jelly-fish which was mistaken for *T. nutricula* resembles in some respects *Podocoryne,* and may perhaps be found to be a new genus and species, for which I suggest the name *Calycidion formosum.* The medusa which was referred in the same paper to *Modeeria* and described as *M. multitentacula,* sp. nov., is probably the same as *T. nutricula,* McCr. As the generic name *Modeeria* is older than *Turritopsis,* and as they seem to have been applied to similar jelly-fishes, McCrady's medusa may later be known as *M. nutricula.*

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* Bull. Mus. Comp. Zoöl., VIII. 7.

New studies must be made to find out whether *M. multitentacula* and *M. nutricula* are the same species.

As my identification * of *T. nutricula* was wrong, my criticisms of McCrady's description of this medusa are unjust to him. The true affinities of the jellyfish which Mr. Agassiz † and myself ‡ called *Turritopsis* are somewhat doubtful. The "pencil-like clusters of stalked thread-cells" upon the lips allies this medusa to that of *Podocoryne carnea*, Sars. In a figure ‡ of *P. carnea*, just escaped from the trophosome, there are eight tentacles, and no rows of lasso-cells extending from the tentacular bulbs to the apex of the bell. The oldest specimens of *C. formosum* have more than eight tentacles. It may, however, be simply a more developed planoblast of *P. carnea*, Sars.

Ectopleura ochracea, A. Ag.

Figs. 15, 16, 35, 36.

The bell of the medusa of *E. ochracea* is high, and has a pointed apex, where its walls are thicker than on the sides. There is no trace of a former tubular connection between the stomach cavity and the fixed hydroid through the apex. The outer surface of the bell walls is crossed by eight rows of lasso-cells, which arise in pairs from the tentacular bulbs and have a common junction at the apex of the bell. Near the bulbs the number of cells in each row is larger than towards the apex, where they become more scattered and smaller (?). The chymiferous tubes are four in number, narrow, and unbranched.

A manubrium hangs down in the bell cavity about two thirds its height. In normal specimens it is never protruded beyond the bell opening. It is divided into three regions, a basal, median, and terminal. The basal division, by which it arises from the bell walls, is more transparent than the others, and is colorless. It contains many large spherical cells. The remainder of the proboscis has a light rosy color, and is divided midway in its length by a slight constriction, which separates it into a median and a terminal region. Both of these portions are more opaque than the hyaline division with large cells already noticed. Near the region where the junction of the median division with the basal takes place there is a zone of ochraceous colored pigment. The constriction forming the division between the median and terminal divisions is marked by a zone of small dark brown pigment-dots. The lips are thickly pigmented with irregular patches of a yellow color. They bear also, according to Mr. Agassiz, small "bunches of lasso-cells."

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* Bull. Mus. Comp. Zoöl., VIII. 7.

† *Op. cit.*, p. 167. Mr. Agassiz suspected that his medusa was not the same as *Turritopsis*, McCr., since he was unable to trace it to a medusa of the same form and color.

‡ Allman, *op. cit.*, Pl. XVI. figs. 3, 4.

There are four rosy flesh-colored tentacles, which are generally carried closely coiled about the tentacular bulbs. Their length, when extended, is greater than the height of the bell. In older specimens they are sometimes extended at full length when the medusa is in motion. At rest they are carried at right angles to the bell walls, or closely coiled about the tentacular bulbs. At intervals along their outer surface the tentacles bear bundles of lasso-cells regularly placed, equally distant from each other. The tentacular bulbs are darkened by orange-colored pigment scattered through their walls, and in many specimens a single black pigment spot (ocellus) is found on the under side. The figures of the fully grown medusa which I have described are from a more advanced stage than those given by Mr. Agassiz.*

The above description of this species differs in some respects from the original account which we have of this medusa. The arrangement of lasso-cells on the tentacles is similar to that in *Sarsia turricula*, McCr.† Although in McCrady's description of *S. turricula* the lines of lasso-cells found on the external bell walls of *E. ochracea* were not observed, in other particulars the two medusæ are so much alike that they probably belong to the same genus. The rows of lasso-cells were probably overlooked in *S. turricula.* The reference of *S. turricula*, McCr. to *Syndictyon*, A. Ag., made by Haeckel, has little to recommend it ‡ except the arrangement of lasso-cells on the tentacles. We now know that the same or a very similar regularity exists in *E. ochracea*, and one more reason for separating the two species *E. turricula*, A. Ag. and *E. ochracea*, A. Ag. vanishes. The want of meridional lines of lasso-cells on the outer bell walls of *E. turricula*, A. Ag. is the main feature by which *E. ochracea* and *Sarsia turricula* are known to differ.§

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* North American Acalephæ, pp. 191, 192.

† Gymnophthalmata of Charleston Harbor. Proc. Eliot Soc. Nat. Hist., 1857. Mr. Agassiz says (*loc. cit.*) : "This species (*ochracea*) differs from the *S. turricula*, McCr., in having the surface of the tentacles covered irregularly with innumerable lasso-cells ; they are not arranged in bundles, as in the Charleston species." According to my observations they are arranged in regular bundles in *E. ochracea.*

‡ For reference of *S. turricula*, McCr. to *Syndictyon*, A. Ag., see Haeckel, *op. cit.* The validity of the genus *Syndictyon* is denied by Allman. (A Monograph of the Gymnoblastic or Tubularian Hydroids. Ray Soc., 1871, p. 284.)

§ *E. turricula* does not seem to be the young of *E. ochracea*, since in the young of the latter of the same age, as judged by the form of the bell, the lasso-cells of the tentacles are "irregularly arranged" according to Mr. Agassiz, while in *S. turricula*, McCr. they are thrown into bundles.

E. ochracea is closely related to *E. Dumortieri*, Van Beneden.

Phialium duodecimale, Haeckel.

Figs. 17-21.

The youngest larval stage of the medusa of *P. duodecimale* * found by us has two long tentacles, which are situated opposite each other on the bell rim. Each tentacle is accompanied by two tentacular spurs or filaments, which arise from the bell margin near the tentacular bulb. The rudiments of two intermediate tentacles are visible as simple projections on the bell margin. A description of this larva, which resembles closely the planoblast, *Lovenella,* is given below.

The bell is tall, almost spherical, with thin walls. Its outer surface is smooth. At the apex there is a remnant of the tube by which the medusa was attached in an earlier stage to its hydroid. It has four simple narrow chymiferous tubes, which are destitute of sexual organs.† Proboscis short, small, with closed mouth. There are four otocysts, each containing a single otolith, and alternating on the bell margin with the radial tubes.

The two larger tentacles are long, coiled in the distal two-thirds of their length, and accompanied by flexible "spurs" or filaments,‡ which arise near their bases.

A still older medusa of *P. duodecimale* differs from the former in having four well-developed tentacles, each of which is accompanied by a pair of lateral filaments. The bell of this larva has a more pointed apex, which has thicker walls than that of the preceding. Sexual glands, four in number, have made an appearance upon the radial tubes near their junction with the circular vessel. There are four otocysts, each alternating with a tentacle. The height of the bell, when expanded, is about two thirds its diameter. When the bell walls are contracted the height and diameter are about equal.

In a medusa more advanced in growth than the last two, additional otocysts have formed between each pair of tentacles, so that we have a stage in which there are four tentacles and twelve otocysts. Between each pair of tentacles there are three marginal sense bodies, instead of a single otocyst as in the larva last described. The beginnings of other tentacles alternating with the otocysts are visible on the bell rim as simple protuberances from the margin.

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* Mr. Agassiz's suggestion (*op. cit.*), that his *Eucheilota duodecimalis* belongs to a different genus from McCrady's *E. ventricularis,* is supported not only by the difference in number of otocysts on the bell margin of the adult, but also by the character of the development of the two. Without adding any new facts to our knowledge of these two forms, Haeckel has already suggested the name *Phialium* for *E. duodecimalis*, A. Ag. The difference in the form of figs.106, 107^a (North American Acalephæ), upon which Haeckel relies, together with the inflated or shrunken condition of the ovaries, for his two species of *Phialium*, does not seem to me to warrant the separation. I therefore retain the specific name *duodecimale* for both.

† The sexual organs are well developed in Prof. Clarke's figure of the medusa of *L. gracilis*, Clarke. They are wanting in Hincks's drawing of *L. clausa*. (Clarke, Mem. Bost. Soc. Nat. Hist., Vol. III. No. IV. Hincks, Ann. Mag. Nat. Hist., VIII., 1871, p. 79, Pl. V. figs. 2-2^b.)

‡ I have not followed a medusa of this age in its development into the following stage. Both stages are common at the same time, and they appear to be the same. Absolute proof is as yet wanting.

The adult is derived from the medusa last mentioned by a change in form of the bell and a growth of the protuberances which form in the last-mentioned larva the beginnings of the new tentacles. In the most developed stage which was taken, the medusa has assumed a form like that figured (107^a) by Mr. Agassiz. The color of the bell of this medusa is light green, and that of the ovaries is white.

The likeness between the youngest *Phialium* which is here described and the planoblast *Lovenella** is so great, that there is no doubt that these two genera are identical. The Lovenella stage of *Phialium* is remarkable, according to Haeckel, in the exceptional number of otocysts, which are generally eight in the young of other Leptomedusæ. The existence of otocysts shows that it has no affinities with the Anthomedusæ, and it is extremely doubtful whether it has any relationship with the Trachymedusæ.†

Epenthesis folleata, McCrady.

Figs. 10-14.

Several specimens of *E. folleata*, McCr. were found at Newport about the end of August.

The differences between this medusa and that of *Oceania languida*, A. Ag. seem to me great enough for a generic separation.

The bell of the adult is low, disk-shaped, and about one sixteenth of an inch in diameter. Walls transparent, thin, with smooth outer surface. There are four narrow, unbranched chymiferous tubes. The sexual organs are small spherical bodies, which hang in the bell cavity from a position on the tubes midway between the base of the proboscis and the bell margin. The proboscis is small, and has a light green color. Its lips are four-lobed and hang down a short distance into the bell cavity. There are sixteen tentacles, which alternate on the bell rim with the same number of otocysts. Each otocyst regularly contains a single otolith. The tentacular bulbs have a red or crimson color. Two clusters of pigment are found in the tentacular bulb. The smallest occupies the position of the ocellus.

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* In what I have identified as a young *Phialium* (Lovenella stage) the small tentacles (spurs) do not arise so near the lithocysts as in Hincks's figures (Ann. Mag. Nat. Hist., VIII., 1871, p. 79, Pl. V. figs. 2^a, 2^b). It however agrees with his drawing in being destitute of ovaries, which are found in the figure of *L. gracilis* given by Prof. Clarke (*op. cit.*).

† Haeckel, *op. cit.*

E. follcata has a habit of swimming with the bell reversed and the proboscis protruded, as shown in Figure 14. This posture is rarely assumed by *O. languida.*

Two larval stages in the growth of *Epenthesis* were observed. The youngest of these has a taller bell than the adult, and seven tentacles with as many otocysts. The disposition of the tentacles and otocysts is as follows. Of the seven tentacles six are well developed, while a seventh is a simple enlargement in the marginal border. In each of three quadrants there are two otocysts, and in a fourth there is a single body of this kind. It is to be noticed that the quadrant which contains the beginning of a new tentacle is situated diametrically opposite that in which no tentacle is found, and in which there is a single otocyst. In the same way the two quadrants which bear the fully developed tentacles are opposite each other. This inequality in the number of tentacles and otocysts leads us at first sight to suppose that this form is a monstrosity. There is, however, a certain regularity in the arrangement of the tentacles and otocysts. We are perhaps hardly justified in supposing that in a stage earlier than the present that quadrant which now bears a rudimentary tentacle separating two otocysts had but a single otocyst, and that in larvæ still younger we have a medusa with four tentacles and a single otocyst in each quadrant. In this way we may interpret the existence in the present form of a quadrant with a solitary otocyst.

An older stage * of the medusa than that with seven tentacles is one with eight tentacles, alternating with as many marginal sense bodies. From this stage the adult is formed by the interposition of a new tentacle between each pair already formed, after the formation of an additional otocyst, either by fission from the last, or by a new growth from the bell margin between each pair of tentacles.

Willia ornata, McCrady.

Figs. 22-24.

The youngest larva of *W. ornata* which was found is very different from the adult. It has a deeper bell and only four tentacles. The bell walls are thin, transparent, and have a smooth surface. There are four narrow, unbranched chymiferous tubes, each of which passes directly from the proboscis to the bell margin. Several specimens of about the same age were taken. In all, the remnant of a communication between the stomach cavity and the hydroid is still visible. There are four short, smooth tentacles,† which are sometimes carried tightly coiled about the base as in *Ectopleura.* They are also sometimes extended.

The structures which identify this larva as the young of *Willia* are four rows of lasso-cells, each situated on the outer surface of the bell in a position slightly removed from the bell rim, and midway between the tentacles. Each cluster is connected with the bell margin by a small body which bears some likeness to one of the peroniæ of *Cunina.*

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* Both of these stages were fished up in the open sea, and not raised one from the other.

† According to Mr. Agassiz (*op. cit.*, p. 171), two of these tentacles are longer than the remaining pair. In my specimens their length was about equal.

This larva is the youngest *Willia* yet figured.* It has been raised into an adult, and there is therefore no doubt of its relationship.

In a *Willia* observed by Dr. Brooks at Beaufort, N. C., there are stolons attached to the outer walls of the manubrium, and upon them are found budding medusæ in all stages of growth.

The accompanying figure † of *Willia* shows a stage in which there are only eight tentacles, and each of the four chymiferous tubes has a single bifurcation. If this budding *Willia* represents a stage in the development of *W. ornata*, it is intermediate between the youngest medusa described above and that which is figured as the youngest *Willia* by Mr. Agassiz. At present, I cannot say from the facts which are known whether it is a new species, a stage in the development of *W. ornata*, or a dimorphous form of the latter. The difference in the chymiferous tubes in it and in *W. ornata* of the same age is very great, as will be seen by contrasting Fig. 24 with those of the young *Willia* by Mr. Agassiz. It may be a new species, *W. gemmifera.*

II. Acalephæ collected by the U. S. Fish Commission during the Summer of 1880 and 1881.

The collection ‡ of medusæ here described was taken by the members of the Commission off the New England coast in the summers of 1880 and 1881. The finds of the latter year were the most valuable, so far as the collection sent to me is concerned.

The collection contains two Ctenophores, which should probably be referred to the genus *Beroë.* The species could not be determined.

Among the Siphonophora there is a magnificent new Physophore, *Haliphyta*, gen. nov., *Agalma elegans*, Fewkes, *Apolemia*, sp., *Diphyes*, sp., and *Gleba hippopus*, Forsk.

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* A medusa doubtfully referred to *Cytæis* by Will (Horæ Tergestinæ, Pl. II. fig. 7) is possibly the same.

† The figure of a *Willia*, with attached stolons, was contributed by the courtesy of Dr. Brooks. Consult his notice, "Budding in Free Medusæ," Amer. Naturalist, Sept., 1880. See also Huxley, Anatomy of the Invertebrated Animals, p. 132. In the *Willia* mentioned by Huxley the stolons arise from the bifurcations of four radial tubes.

‡ An assorted collection from which Prof. Verrill had excluded many previously known medusæ collected by the commission at the same time. For an account of the explorations in the summer of 1881, see Prof. Verrill's paper, Am. Jour. Arts and Sci., XXII., Oct. 1881.

The only Discophores sent me are *Periphyllia hyacinthina*, Steen., and an unknown genus of the Pelagidæ. Three new hydroids represented by several specimens were found. The whole material upon which my observations were made is as follows.*

	Station.		No. Spec.
CTENOPHORA.			
Beroë, sp.	920		1
DISCOPHORA.			
Periphyllia hyacinthina, Steen.	936	Surface.	2
" " "	936		3
" " "	954		2
" " "	952		3
" " "	995		7
Fam. Pelagidæ. Genus could not be identified.	936		3
SIPHONOPHORA.			
Apolemia.	Off Block Island, 1880.	Surface, No. 6538.	1
Agalma elegans.	Gulf Stream.		
Gleba (Hippopodius) hippopus.	925		1
Haliphyta magnifica, gen. et sp. nov.	953		1
Diphyes.			
HYDROIDA.			
Trachynema digitale, A. Ag.	985	Trawl wing.	2
" " "	1026	"	3
Calycopsis typa, gen. et sp. nov.	924		3
" " " "	870		1
" " " "	952	Trawl wing.	1
" " " "	945		1
Chromatonema rubrum, gen. et sp. nov.	936		3
" " " "	954		2
" " " "	936		1
" " " "	936		1
Halicreas minimum, gen. et sp. nov.	1029		1
" " " "	954		1

DISCOPHORA.

Periphyllia hyacinthina, STEEN.†

Many specimens of the young of this medusa were taken.

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* For locations and depths corresponding to the stations, see Prof. Verrill's lists, *op. cit.*, XX. p. 391, and *loc. cit.*, pp. 292, 294.

† Peron designated two very different medusæ under the name *Carybdea periphylla*. One of these was undoubtedly the above mentioned, while the other was

SIPHONOPHORA.

PHYSOPHORIDÆ.

Apolemia, sp. (Provisional.)

A fragment of an *Apolemia* * stem from which covering-scales and nectocalyces have been broken off was taken by the commission.

Agalma elegans, Fewkes.

A mutilated specimen of a Physophore which is identified as belonging to this species is found in the collection made in 1880. The locality given is "Gulf Stream, surface."

Haliphyta magnifica, gen. et sp. nov.

Figs. 39, 40.

The most interesting, and at the same time tantalizing find, was a magnificent new Physophore, which was destitute of both nectocalyces and tentacular knobs. These structures, so important in generic determinations of Siphonophores, had evidently been detached from the stem in the capture of the animal, and we must wait for future observations to determine their form. The structures, however, which remain, especially the covering-scales, polypites, and stem, show that the genus to which they belong is different from any which have yet been described.

The genera with which *Haliphyta* is liable to be confounded are *Stephanomia* M. E., *Halistemma*, Huxley, *Agalma*, Esch., and *Agalmopsis* (restricted sense). Although in the broken specimen before me the nectocalyces and tentacular knobs, the structure of which has generally been relied upon for generic differences, are gone, from what is left there can be no doubt that the animal to be described is a type of a new genus.

The polypites of *Stephanomia* differ from those of *Agalma*, *Agalmopsis*, and *Halistemma* in possessing long peduncles. *Haliphyta* seems to have the same long peduncles as *Stephanomia*. Unlike *Stephanomia* (*Forskalia*) the margin of the few covering-scales which remain in the bottle with our new genus and attached to its axis is not indented or notched. When placed in alcohol the

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the same with or very similar to *Carybdea marsupialis* of later authors. Steenstrup's name *Periphylla* is followed to designate the first of these forms, since the generic name *Carybdea* is commonly given to the latter. (Cf. Haeckel, *loc. cit.*, I. 2, pp. 416 and 439.) The Discophore which I have identified as *Dodecabostrycha dubia*, Brandt, is probably the same. (Cf. Bull. Mus. Comp. Zoöl., VIII. 7.)

* The stem of this specimen is twisted in the same direction as that of alcoholic *Apolemia uvaria* brought from Naples. No identification of species could be made.

stem of *Stephanomia* is generally contracted into a closely coiled spiral. The alcoholic stem of *Haliphyta* is uncoiled.

A description * of what remains of the single specimen of *Haliphyta* is as follows. The parts remaining which could be identified were the float, stem (nectostem and polyp-stem), a few covering-scales, polypites, a broken tentacle, and clusters of sexual bells. Although no nectocalyces are found, their former existence is indicated by a well-marked nectostem and a cluster of immature swimming-bells (always the most adherent of these bodies) just below the float. Nectocalyces, with the exception of the cluster just mentioned, are more readily detached from the stem than any other structures, and they were probably broken from their connections with the axis at the time of capture.

The float is a small, pear-shaped, colorless body, slightly inclined to one side in its attachment to the stem. The nectostem is larger in diameter than that of any other genus, not excluding gigantic specimens of *Apolemia.* The contracted axis is about a quarter of an inch in diameter. It is not twisted in contraction. The nectostem has a smooth surface with the exception of one side, on which is placed a row of small tubercles, which I have considered former points of attachment of the absent nectocalyces.

The polyp-stem is a little more in diameter than the nectostem, and is jointed. Many detached joints from the distal end are found in the bottle, while several of the joints, although partially severed, hang adherent to the remainder of the axis.

The appendages to the polyp-stem all arise from one side of the stem, which by its contraction in spirit has thrown them in such confusion that their normal arrangement cannot be satisfactorily determined. The walls of the stem are very thick, and its terminal end opposite the float is not enlarged into a sac, as occurs in *Physophora.*

Several detached covering-scales are found in the bottle, and a few still hang from the stem. They have a spatulate outline, continuous margin, and resemble the bracts of *Agalma.* A small orange-colored tube † (somatocyst) passes through the middle of each covering-scale, and opening into the stem cavity.

The polypites are very large, and in alcohol are contracted into an almost globular shape. They have a bright vermilion color, which must have imparted to this Physophore, when alive, a very beautiful appearance. The polypites seem to have been mounted upon a long peduncle, which is also contracted into a spherical shape. Upon the basal part of the polypite we find two kinds of appendages arranged in clusters.

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* A few sketches of this Physophore made by Mr. Emerton shortly after the specimen was placed in alcohol have been of assistance in my studies. I have also made use of a few of his notes as regards the color of the tastern and covering-scales.

† This tube was colorless when the specimen came into my hands. Mr. Emerton, who observed it shortly after the medusa was placed in spirit, has indicated its color as bright orange. The central tube of the bract of known species of *Agalma, Agalmopsis, Halistemma,* and *Stephanomia* is colorless.

The first cluster is composed of a bundle of simple filaments. They are probably undeveloped tentacular knobs. The second cluster has a botryoidal shape, and is composed of small spheres closely packed together. They are regarded as the female sexual bells. From the base of a single polypite hangs the stump of a large tentacle, which is destitute of appendages.

The tastern are very characteristic in *Haliphyta.* They are long, flask-shaped structures, and are mounted on a slender peduncle. There is no filament in the tastern of the specimen studied. Their color is bright orange.*

HIPPOPODIDÆ.

Gleba hippopus, Forsk.

Figs. 31-33.

This beautiful medusa, somewhat mutilated, was taken off Martha's Vineyard, Station 925. The nectocalyces are sufficiently well preserved to show that it is identical with the Mediterranean species which is so well known.†

In the cruise of the "Blake" in the summer of 1880, Mr. Agassiz collected a second specimen of this Siphonophore in the Gulf Stream.

DIPHYIDÆ.

Diphyes, sp.

A specimen of *Diphyes* too imperfect for specific determination is found in the collection.

HYDROIDA.

Calycopsis typa, gen. et sp. nov.

Fig. 34.

Several specimens of a medusa which closely resembles *Turris neglecta,* Haeck. were collected. The structure of this jelly-fish is so exceptional that it is given a new generic name. Bell high, without apical protuberance. Bell walls thin, with external surface smooth. The inner surface of the bell is crossed by sixteen radial tubes, each of which passes without bifurcation directly from the proboscis to the bell margin. These vessels are narrow, and in alcoholic specimens resemble white lines on the surface of the bell walls. Four of them arise from the point of union of the ovaries to the proboscis, while three are found intermediate between each pair. The size of all is uniform.

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* Mr. Emerton's notes mark what is here identified as a taster as bright orange. Even in the alcoholic specimens which were studied there were traces of this color.

† A direct comparison between this and specimens of *G. hippopus* brought from Villa Franca show that they are the same.

From the termination of each radial tube on the bell margin hangs a long flexible tentacle, which is unbranched, and in alcoholic specimens appears to be enlarged at the distal end. There are sixteen tentacles in most specimens. Several had less, but none more than this number.

No otocysts were found on the bell rim.

The ovaries are four in number, and in all the specimens are very well developed. They cover the outer walls of the proboscis, and seem to fill almost the whole of the upper part of the bell cavity. Each gland consists of many small leaflets arranged in parallel rows side by side, and opening into a tube which is a continuation along the surface of the proboscis of one of four radial vessels. By the method of attachment of the ovaries to the proboscis and the inner walls of the bell, the upper part of the bell cavity is separated into four recesses, which are divided from each other by partitions. These recesses are bounded above by the apex of the bell, on one side by the bell walls, and on the other sides by the partitions mentioned above and the walls of the proboscis. Upon the lower edge of the partitions which separate the recesses pass the chymiferous tubes, from the ovaries to the inner surface of the bell.

The lips about the mouth are so poorly preserved that their structure could not be satisfactorily made out. The color of the ovaries in alcohol is dark brown ; the bell walls and tentacles are white, with a tinge of bluish color.

The relationship of this medusa to forms like *Turris* is very great, so far as the general character and place of attachment of the ovaries is concerned. The existence in *Calycopsis* of sixteen radial tubes instead of four, is a feature which it shares with none of the Anthomedusæ. On the other hand, my failure to find otocysts on the bell rim seems to support the reference of it to Tubularian-like jelly-fishes. The otocysts could not be found after a persistent search, and are probably wanting. If sense bodies of this kind are present in *Calycopsis*, the place of attachment of its ovaries has such a strong likeness to those of *Turris* that the medusa would combine extraordinary features and be a most abnormal form, the number of radial tubes is so great.

Chromatonema rubrum, gen. et sp. nov.

Fig. 40.

Several specimens of a large hydroid medusa in a distorted condition, and apparently allied to *Staurophora* in the position of the sexual organs, were found.

The form of the bell is shown in the figures. There are four red-colored chymiferous tubes, near the origin of which from the proboscis are situated the ovaries. The sexual glands are confined to the upper part of the bell, hanging from the chymiferous tubes for about one third their course. Their color is bright red. No otocysts were found. The number of tentacles varies from twelve to sixteen. In alcohol their color is red. The affinities of this medusa are somewhat difficult to make out, and it is provisionally named *C. rubrum* until future observations can complete this imperfect sketch.

Halicreas minimum, gen. et sp. nov.

Two specimens * of a new and highly interesting jelly-fish closely related to the Narcomedusæ were found by the members of the Commission.

Halicreas, gen. nov.

The genus *Halicreas* differs from other medusæ in possessing eight prominent rounded projections covered with tubercles on the bell margin at the extremity of eight radially arranged ribs passing from centre to circumference of the bell. No proboscis. No tentacles. It has eight sausage-shaped ovaries hanging into the bell cavity from its upper surface.

H. minimum, sp. nov.

The bell of the alcoholic specimen is flat, disk-shaped, translucent, white. In its walls are eight radial stripes, which were at first mistaken for radial tubes. They are, however, simple thickenings of the bell walls, and in general character are not unlike the radial stripes of *Cassiopea*. No opening was traced from them into the stomach, and they seemed to be solid throughout. Each of these radial stripes terminates on the bell margin near a prominence which is very marked in both specimens. This protuberance bears many small rounded papillæ. No remnant of tentacles was observed hanging from these tubercles or from the papillæ. Tentacles are also absent on the bell margin between the prominences. The margin of the bell between two marginal prominences is smooth and destitute of otocysts. A narrow "velum" (?), which probably forms the sides and lower floor of a stomach, hangs down in both specimens from the bell rim.† In the specimen preserved in chromic acid this structure is very much convoluted on account of the contracted condition of the bell walls. No otocysts were observed on its lower rim. Chymiferous tubes are wanting in the bell walls of both specimens. No circumferential vessel. There is no proboscis, and the stomach seems to resemble that of *Cunina discoides*. Its upper wall is the wall of the bell, and its floor the surface of the "velum."

Eight ovaries hang into this gastral cavity. They are sausage-shaped, and arise near the centre of the disk in the intervals between the radial stripes mentioned above. In them individual eggs can be easily distinguished in the chromic acid specimen. The diameter of the larger specimen is about three fourths of an inch.

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* One of these had the disk expanded, and was preserved in spirit. The other was contracted, globular, and less translucent. It resembles a jelly-fish preserved in chromic acid. The second specimen had eight ovaries hanging down in the bell cavity. These organs were wanting in the former specimens, but the scars where they formerly were attached still existed.

† Circumference of the disk connecting the prominences.

The combination of structures which could be made out with any certainty in these two specimens of *Halicreas* certainly stamp it as a most peculiar jellyfish. Little stress, however, can be placed on the failure to find certain essential organs, as the tentacles, otocysts, and the like. Tentacles may have existed and have been broken off in the capture of the medusa, leaving the bases as stumps. Such a condition almost invariably results in alcoholic Trachymedusæ. If I am not wrong in my interpretation of the systematic position of *Halicreas*, the otocysts, if any exist, should be searched for on the inner or lower rim of that body which has been called the velum. In both the specimens before me that structure is so contorted that, even if sense organs existed, they could not be found or counted. There are certainly no marginal sense bodies on the interval between each marginal tubercle.

The knowledge which we have of the structure of this medusa is so fragmentary that it is at present impossible to determine its affinities. It seems to me most closely allied to the Narcomedusæ, Haeckel, but differs from them all in the eight radial stripes in the bell and the eight marginal tubercles. On the other hand, there are no marginal lappets as in Discophora, and the "velum" indicates a true hydroid medusa. The prominent marginal tubercles at their extremities are wanting in all other medusæ with which I am acquainted. The genus is the type of a new family related to the Discophora more intimately than are the Narcomedusæ, among which it will probably be placed.

EXPLANATION OF THE PLATE.

LETTERS.

A.	*a.*	Auricles.
	a t.	Auricular vessels.
B.	*b o.*	Bell opening.
	b w.	Central part of the nectocalyx.
C.	*c.*	Bifurcation of tubes from the funnel.
	ca.	Cavity.
	c c.	Primary divisions of *c.*
	c l.	Connection between the otocyst and the rows of combs.
	c i.	Wings of bell.
	c t.	Termination of the chymiferous tubes in marginal lappets.
D.	*d.*	Tentacular cavity (basal).
E.	*c e.*	Clusters of lasso-cells.
F.	*f.*	Funnel.
G.	*g.*	Remnant of former tubular connection with hydroid or medusa.
	g m.	Lasso-cells.
H.	*h.*	Lasso-cells.
	h d.	Hood.
I.	*i.*	Chymiferous tubes.
	i r.	Inner recesses (Riechgrübschen).
J.	*j.*	Peduncle.
K.	*k.*	Budding stolon.
L.	*l.*	Lateral tubes.
	l m.	Muscular layer on under floor (color white).
	l d.	Gelatinous tissue.
	l l.	Bifurcation of lateral tubes.
	l t.	Lobular vessels.
M.	*m.*	Mouth.
	m f.	Muscular fibres.
	m l.	Marginal lappets.
	m p.	Pigment.
O.	*oc.*	Ocellus.
	o l.	Oral lappets.
	ov.	Ovaries.
	o i.	Enlargement of a chymiferous tube.
	ot.	Otocyst.
	otc.	Cavity between the marginal lobes into which the marginal sense body projects.

	ot i.	Chymiferous tube passing to the otocyst.
P.	*p.*	Proboscis.
	p b.	Mass of pigment.
	p s.	Pigment spots.
R.	*r.*	Outer pit (Riechgrübschen).
	r t.	Tentacular base.
S.	*s.*	Stomach.
	sp.	"Spurs" (small filaments or tentacles).
	st.	Somatocyst.
T.	*t.*	Tentacle.
	t^a.	Small intermediate tentacles.
	tf.	Tentacular appendages.
	t m.	Basal portion of the tentacle into which it is absorbed.
	t e.	Distal enlargement of the tentacle.
	t t.	Tentacular tubes.
U.	*u.*	Basal portion of proboscis.
	u m.	Gelatinous part of the lower floor (color pink).
V.	*v.*	Pigment in median portion.
	ve.	Velum.
W.	*w.*	Constriction which separates median and distal portions.
	w m.	Long cells (*?*).
X.	*x.*	Pigment dots near constriction.
Y.	*y.*	Scattered pigment.
Z.	*z.*	Half-absorbed tentacular appendage.

FIGURES.

1–9. Larval stages illustrative of the development of the chymiferous tubes of *Mnemiopsis Leidyi*, A. Ag.

1. Youngest larva just escaped from the shell (egg sac). The view is taken in a plane passing through the tentacles and the otocyst.

1 *a*. A larval *Mnemiopsis* seen from the actinal pole.

2–4. Stages in growth illustrating the elongation of the chymiferous vessels previous to their union.

5. Young *Mnemiopsis* in which the lobular tubes (*l t*) have united.

6. The same, still older than the last.

6 *a*. View of fig. 6 in a plane at right angles.

7. A stage more advanced than the last, in which the auricles have begun to form.

7 *a*. View of fig. 7 at right angles to the plane of the last.

8. A larva in which the lateral and auricular tubes have united.

9. Young *Mnemiopsis* with well-developed auricles and oral lobes.

9 *a*. Base of the tentacle of young *Mnemiopsis*.

10–14. Larval stages of *Epenthesis folleata*, McCr.

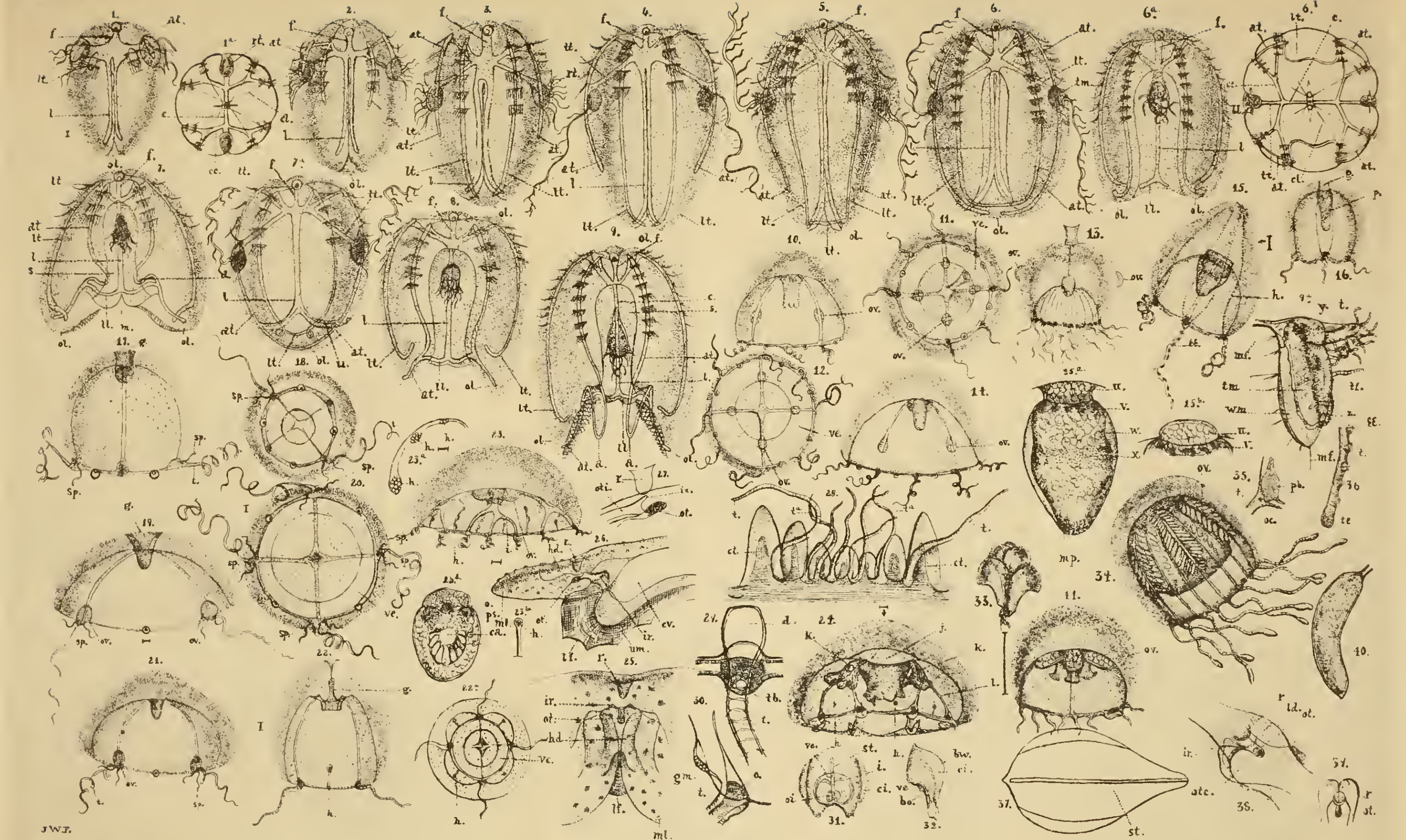
10. Side view of the young, with six tentacles and beginnings of a seventh.

11. The same (oral view).

12. Young *E. folleata* with eight tentacles (oral view).

13. *E. folleata* with bell reversed.
14. Side view of the young *Epenthesis* with eight tentacles.
15. Adult *Ectopleura ochracea*, A. Ag.
15 *a*. Magnified proboscis of the same.
15 *b*. Magnified basal part of the proboscis when retracted.
16. Youngest larva observed of *E. ochracea.*
17. Youngest medusa of *Phialium duodecimale*, Haeck.
18. The same (oral view).
19. An older stage of *P. duodecimale* (bell expanded).
20. The same (oral view).
21. The same (bell contracted).
22. Youngest larva of *Willia ornata*, McCr.
22 *a*. The same (oral view).
23. Older larva of *W. ornata.*
23 *a*. A row of three clusters of lasso-cells found on the external walls of *W. ornata.*
23 *b*. A single cluster of lasso-cells from the external wall of the youngest *Willia* (fig. 22).
23 *d*. Tentacular bulb of *W. ornata* (optical section).
24. *Willia*, sp., with budding stola.
25. Marginal sense body of *Dactylometra quinquecirra*, A. Ag. (The marginal lobes are infolded.)
26. The same (side view with marginal lobes extended).
27. The relative position of the outer pit and the otocyst of the same.
28. Portion of the bell margin of *D. quinquecirra* between two marginal sense bodies.
29. Tentacular bulb of *Eucope.*
30. Tentacular bulb of *Gemmaria gemmosa*, McCr.
31. Nectocalyx of *Gleba hippopus,* Forsk.
32. The same (side view).
33. *G. hippopus* with retracted stem.
34. *Calycopsis typa*, gen. et sp. nov.
35. Tentacular bulb of *Ectopleura ochracea.*
36. Portion (terminal) of the tentacle of the last.
37. Covering scale of *Haliphyta magnifica*, gen. et sp. nov.
38. Inner pits, "Riechgrübschen," of the marginal sense body of *D. quinquecirra.*
39. The inner pits from above.
40. Taster of *Haliphyta magnifica.*
41. *Chromatonema rubrum*, gen. et sp. nov.

CAMBRIDGE, April 1, 1882.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BULLETIN

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT

HARVARD COLLEGE, IN CAMBRIDGE.

VOL. X.

CAMBRIDGE, MASS., U. S. A.
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No. 1. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *on the East Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XVII.

Report on the Crustacea. Part I. DECAPODA. *By* SIDNEY I. SMITH.

THE part of the following report relating to the Macrura was ready for the printer before Alphonse Milne-Edwards's *Description de quelques Crustacés Macroures provenant des grandes profondeurs de la Mer des Antilles* (Annales Sci. Nat., Zool., 6^{me} série, XI. No. 4, 1881) was received, so that all the references to it have been added subsequently. The new species in this and some other recent papers of Milne-Edwards, and in Bates's recent paper on the Penæidea, are so imperfectly characterized that in several cases I have found it impossible to determine, with any approximation to certainty, whether or not they are identical with species described in the following pages. I have endeavored, however, to make the descriptions and figures of the species here described so complete, that subsequent investigators will not labor under a similar difficulty in regard to them.

BRACHYURA.

MAIOIDEA.

Amathia Agassizii, sp. nov.

Plate II. Figs. 2, 3.

Resembles *A. Carpenteri* Norman (figured by Wyville Thomson, Depths of the Sea, p. 175, 1873), but has shorter rostral horns and more numerous spines upon the carapax.

The carapax is sub-triangular, excluding spines and rostral horns, nearly four fifths as broad as long, or with the breadth including spines about equal to the length excluding the rostral horns, which are strongly divergent, nearly straight, and in the adult less than half as long as the rest of the carapax. The supra-orbital spines are large, acute, and much more prominent than the obtuse post-orbital processes. The basal segment of the antenna is armed with two large and nearly equal spines beneath the eye, one near the base, the other near the tip. The hepatic region projects above the lateral margin in a prominent spine about a third of the way from the orbit to the great branchial spine. The anterior angles of the buccal area project in angular dentiform processes, back of which the prominent margin of the pleural region is armed with two or three small and unequal spines. There are six spines or spiniform tubercles on the gastric region, two median, and each side two slightly smaller lateral, which are nearer together than the median. There are three median spiniform tubercles on the cardiac region, of which the middle one is much the more prominent, and back of these the posterior margin of the cardiac region projects in a prominent median spine, either side of which the postero-lateral margin is ornamented with a regular series of six or seven minute tubercles. The middle of the branchial region projects in a spine directed straight outward and a little upward, which is the largest upon the carapax, and about half as long as the rostral horns ; on a line between this and the postero-lateral gastric spine there are two spines near together ; and back of these on the posterior part of the region there is a single spine opposite the large cardiac spine. In addition to these dorsal spines of the branchial region there is a lateral closely set series of three or four small spines just below the pleural suture and above the base of the cheliped, and a similar but isolated spine below and back of the great branchial spine. The entire surface of the carapax and of the sternum, and of the exposed parts of the appendages, except the terminal portions of the chelæ and of the dactyli of the ambulatory legs, is covered with soft scabrous papillæ, and sparsely clothed with short setæ.

The chelipeds are a little longer than the carapax including the rostral horns, and scarcely stouter than the ambulatory legs ; the chela is nearly as long as and no stouter than the merus, the basal portion subcylindrical, nearly naked and smooth except for minute, scattered papillæ, like those on the surface generally except that they are smaller and much more scattered ; the digits are a little more than half as long as the basal portion, a little curved, slightly compressed, smooth, and with the prehensile edges regularly dentate. The ambulatory legs are all armed with a dentiform spine at the distal end of the merus ; the first pair are nearly twice as long as the chelipeds, and the succeeding pairs are successively a little shorter.

The second and third segments of the abdomen of the male are expanded, and the first and second are each armed with a small median tubercle.

Station 319, N. Lat. 32° 25′, W. Long. 77° 42′ 30″, 262 fath. ; 1 ♂.

A very much smaller specimen (Plate II. fig. 3) from Station 317 differs so much from the one above described that it might readily be mistaken for a distinct species. It is apparently an immature male, and differs in having a narrower carapax, with much longer rostral horns and fewer and much longer spines.

The carapax, excluding the rostral horns and lateral spines, is about two thirds as broad as long; the rostral horns are as long as the breadth of the carapax excluding the spines, nearly straight, slender, and very acute. There are two spines upon the basal segment of the antenna, but the proximal is much smaller than the distal. The hepatic spine is slender, and about a fourth as long as the rostral horns. There is only one small spine, or one with the rudiment of a second, on the margin of the pleural region back of the anterior angle of the buccal area. The two median spines of the gastric region are slender and conspicuous, the posterior much the larger, but there are no lateral spines. The middle spine of the cardiac region is as long as the hepatic, and in front of its base there is a rudiment of a second; the posterior cardiac spine is slender and very little shorter than the hepatic, but there are no spines or tubercles either side its base. The middle spine of the branchial region is slender, and more than half as long as the rostral horns; there is a single small spine in place of the two anterior branchial; a small posterior branchial is present; and in place of the series of small spines there are two very minute tubercles.

The chelipeds and ambulatory legs are nearly as in the other specimen, but the chelæ and the dactyli of the ambulatory legs are a little more hairy.

Station 317, N. Lat. 31° 57′, W. Long. 78° 18′ 35″, 333 fath.

The two specimens give the following measurements.

Station	319	317
Sex	♂	Young
Length of carapax including rostrum and posterior spine	35.2 mm.	13.1 mm.
Length of carapax from base of rostrum to tip of posterior spine	27.5	8.4
Length of rostral horns	8.5	5.1
Breadth of carapax, including lateral spines	27.0	10.5
" " excluding " "	20.3	5.1
Length of branchial spine	4.5	3.0
" cheliped	37	8
" first ambulatory leg	63	16
" second "	43	13

Since the above was written several specimens of this species have been taken off Martha's Vineyard by the United States Fish Commission. All these specimens are intermediate in size between those above described, and show that they are really, as supposed, stages of growth of a single species.

Hyas coarctatus Leach.

One young specimen, Station 301, N. Lat. 41° 26′ 55″, W. Lon. 66° 3′, 71 fath.

Euprognatha rastellifera Stimpson.

Stimpson, Bull. Mus. Comp. Zoöl., II. p. 123, 1870.
A. M.-Edwards, Crust. Région Mexicaine, p. 183, Pl. XXXIII. fig. 2, 1878 ; Bull. Mus. Comp. Zoöl., VIII. p. 7, 1880.
Smith, Proc. National Mus., Washington, III. p. 415, 1881.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
335	38° 22′ 25″	73° 33′ 40″	89	1 ♂.
345	40° 10′ 15″	71° 4′ 30″	71	70 ♂ ♀.
346	40° 25′ 35″	71° 10′ 30″	44	1 ♀.

This is apparently by far the most abundant of all the Brachyura along our whole eastern coast south of Cape Cod in the belt from 50 to 200 fath. depth. In the U. S. Fish Commission dredgings off Martha's Vineyard, many thousands of specimens were often taken at a single haul of the trawl.

CANCROIDA.

Cancer irroratus Say.

Cancer irroratus Say, Jour. Acad. Nat. Sci. Philadelphia, I. p. 59 (♂ only, ♀ being *C. borealis*), Pl. IV. fig. 2, 1817.
Stimpson, Ann. Lyceum Nat. Hist. New York, VII. p. 50 (4), 1859.
Smith, Trans. Conn. Acad., V. p. 38, 1879.
Kingsley, Proc. Acad. Nat. Sci., 1879, p. 391, 1880.
Platycarcinus irroratus M.-Edwards, Hist. Nat. Crust., I. p. 414, 1834.
DeKay, Nat. Hist. New York, Crust., p. 6 (in part), Pl. II. fig. 2, 1844.
Cancer Sayi Gould, Invertebrata Massachusetts, 1st ed., p. 323, 1841.
Platycarcinus Sayi DeKay, *op. cit.*, p. 7, 1844.
Cancer borealis Packard, Memoirs Boston Soc. Nat. Hist., I. p. 303, 1867.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
314	32° 24′ 0″	78° 44 0″	142	2 ♀.
327	34° 0′ 30″	76° 10′ 30″	178	6 ♂, 2 ♀.
333	35° 45′ 25″	74° 50′ 30″	65	1 ♂.

The occurrence of this abundant shallow-water and littoral northern species in deep water south of Cape Hatteras is very interesting. As a littoral species it is apparently not abundant south of Cape Hatteras, and on the New England coast fully grown individuals are certainly rare below twenty fathoms. The alcoholic specimens from deep water are lighter in color than similar specimens from shallow water, but this may be partially due to the fact that they are entirely devoid of all algoid growths which are common on shallow-water individuals ; and the edges of the carapax appear more acutely dentated, which is easily explained by the fact that they are not subjected to the abrading influence of sand and gravel as the shallow-water specimens are. The following measurements show no appreciable difference from shallow-water specimens in the proportions of the carapax.

Station.	Sex.	Length of Carapax.	Breadth of Carapax.	
333	♂	25.0 mm.	38.7 mm. =	1.55 lgth.
327	"	36.3	56.0	1.54
"	"	37.2	59.0	1.59
"	"	37.2	59.1	1.59
"	"	40.5	64.8	1.60
"	"	41.0	64.8	1.58
"	"	59.7	94.0	1.59
"	♀	39.0	61.5	1.58
"	"	39.1	62.0	1.56

Cancer borealis Stimpson.

Cancer irroratus Say, Jour. Acad. Nat. Sci. Philadelphia, I. p. 57, 1817 (♀ only, ♂ being *C. irroratus*).

Gould, Invertebrata Massachusetts, 1st ed., p. 322, 1841

Stimpson, Invertebrata Grand Manan, p. 59, 1853 (*teste* Stimpson).

Platycarcinus irroratus DeKay, Nat. Hist. New York, Crust., p. 6 (but not the fig.), 1844.

Cancer borealis Stimpson, Ann. Lyceum Nat. Hist. New York, VII., p. 54 (4), 1859.

Smith, Inverteb. Vineyard Sd., Report U. S. Fish Com., I. pp. 546 (252), 745 (451), 1874; Trans. Conn. Acad., V. p. 39, Pl. VIII. 1879; Proc. National Mus., Washington, III. p. 417, 1881.

Kingsley, Proc. Acad. Nat. Sci. Philadelphia, 1878, p. 317 (2).

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
314	32° 24′ 0″	78° 44′ 0″	142	1 ♂, 3 ♀, 3 young.
321	32° 43′ 25″	77° 20′ 30″	233	6 ♂, 4 ♀.
327	34° 0′ 30″	76° 10′ 30″	178	3 ♂, 1 ♀, 8 young.

Fifteen of the specimens give the following measurements.

Station.	Sex.	Length of Carapax.	Breadth of Carapax.	
314	Young.	15.2 mm.	21.5 mm. =	1.41 lgth.
"	"	16.7	24.3	1.45
321	♀	22.3	33.2	1.48
"	"	25.3	38.0	1.50
327	"	47.0	73.0	1.55
314	"	49.3	76.0	1.54
321	♂	32.5	49.0	1.51
"	"	38.0	59.5	1.56
314	"	46.0	72.0	1.56
327	"	47.0	74.5	1.59
321	"	47.6	75.5	1.59
327	"	63.0	101.2	1.60
"	"	76.0	120.0	1.58
314	"	78.0	123.0	1.58
"	"	80.0	129.0	1.61

This species has also been taken in considerable abundance, in 50 to 200 fathoms, off Martha's Vineyard, by the U. S. Fish Commission. The remarks under the last species in regard to coloration, acuteness of the dentation of the edge of the carapax, etc., apply equally well to this species. The fact that this species and *C. irroratus* as well are regular inhabitants of the deep water off our southern coast is sufficient to account for their occasional occurrence in shallow water at the Bermudas, and even in the West Indies.

Cancer Bellianus Johnson (Proc. Zoöl. Soc. London, 1861, p. 240, Pl. XXVIII.) from Madeira, is much like this species, but apparently distinct from it.

Geryon quinquedens Smith.

Trans. Conn. Acad., V. p. 35, Pl. IX. figs. 1–1 *b*, 2, 1879 ; Proc. National Mus. Washington, III. p. 417, 1881.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
325	33° 35′ 20″	76° 0′ 0″	647	1 ♂
332	35° 45′ 30″	74° 48′ 0″	263	2 ♂
334	38° 20′ 30″	73° 26′ 40″	395	2 ♂
337	38° 20′ 8″	73° 23′ 20″	740	Fragments only.
343	39° 45′ 40″	70° 55′ 0″	732	3 ♀ with eggs.
309	40° 11′ 40″	68° 22′ 0″	304	1 ♂, 1 ♀ "
312	39° 50′ 45″	70° 11′ 0″	466	1 ♂

These specimens and others recently obtained by the U. S. Fish Commission show that this species grows to be one of the largest of the Brachyura. The very large individuals differ considerably from the specimens originally described. In all the large specimens the teeth of the antero-lateral margin of the carapax become reduced to angular tubercles, and in some of the larger ones the fourth tooth becomes entirely obsolete. Thus in specimens No. 2, 3, 5, 7, and 8 of the table of measurements given below, the fourth tooth is distinct; in No. 9, distinct, but very obtuse ; in No. 4, distinct, but the right side of the carapax deformed by some injury ; in No. 1, nearly obsolete ; while in Nos. 6 and 10 it is entirely obsolete.

Ten specimens give the following measurements : —

No.	Station.	Sex.	Length of Carapax.	Breadth including spines.		Breadth excluding spines.	
1	312	♂	41.0 mm.	51.6 mm. =	1.26 lgth.	45 mm. =	1.10 lgth.
2	309	"	54.0	65.5	1.21	61	1.13
3	334	"	81.0	97.0	1.20	89	1.10
4	"	"	94.0	113.0	1.20	104	1.11
5	332	"	116.0	136.5	1.18	128	1.10
6	"	"	130.0	152.5	1.17	144	1.11
7	309	♀	47.5	61.0	1.28	55	1.16
8	343	"	82.5	99.5	1.21	92	1.12
9	"	"	84.0	100.0	1.19	91	1.18
10	"	"	92.0	107.5	1.17	101	1.10

In four of the above specimens the greatest expanse of the ambulatory legs, which is at next to the last pair, is as follows. No. 5, 540 mm.; No. 6, 625 mm. (24.6 inches); No. 8, 380 mm.; No. 10, 417 mm. The chelæ are almost exactly alike on the two sides, and in the largest male and largest female give the following measurements: —

	Right Chela.			Left Chela.		
	Length.	Height.	Length of Dactylus.	Length.	Height.	Length of Dactylus.
No. 6	114 mm.	42	62	112	38	62
" 10	68	25	39	68	23	38

OXYSTOMATA.

CALAPPIDÆ.

Acanthocarpus Alexandri Stimpson.

Stimpson, Bull. Mus. Comp. Zoöl., II. p. 153, 1870.
A. M.-Edwards, Ibid., VIII. p. 19, Pl. I. fig. 2, 1880.
Smith, Proc. National. Mus., Washington, III. p. 418, 1881.

Station 345, N.Lat. 40° 10′ 15″, W. Long. 71° 4′ 30″, 71 fathoms. A single male recently moulted and very soft, the carapax about 36.0 mm. long and 36.1 broad. It has also been taken at several stations off Martha's Vineyard by the U. S. Fish Commission in 1880 and 1881, and in living specimens from these stations the dorsal surface of the carapax and chelipeds was pale reddish orange, deepest in color upon the elevations of the carapax and upon the bases of the carpal spines of the chelipeds; while the carapax beneath, the sternum, abdomen, and the under surfaces of the chelipeds and ambulatory legs are white, very slightly tinged with reddish.

DORIPPIDÆ.

Cyclodorippe nitida A. M.-Edwards.

Bull. Mus. Comp. Zoöl., VIII. p. 24, 1880.

Plate II. Figs. 1-1^b.

Station 319, N. Lat. 32° 25′, W. Long. 77° 42′ 30″, 262 fath. One specimen, which gives the following measurements: —

Station	319
Sex	♀
Length of carapax to middle of front	6.1 mm.
" " including frontal teeth	6.4
Breadth between tips of lateral teeth	6.9
Greatest breadth back of lateral teeth	6.9
Length of cheliped	10.0

Length of chela	5.0 mm.
Breadth of “	1.7
Length of its dactylus	2.8
“ first ambulatory leg	9.0
“ dactylus	2.0
“ second ambulatory leg	11.6
“ dactylus	3.2
“ telson	2.5
Breadth of “	4.8

ANOMURA.

LITHODIDEA.

Lithodes Agassizii, sp. nov.

Plate I.

This species is allied to *L. maia* and *L. antarctica* in having no scale and only a single spine at the base of the antenna, and in the general form and armament of the carapax and appendages, but differs from them both conspicuously in the rostrum, which is rather short and tridentate, with the lateral spines nearly as long as the rostral spine itself. The spines upon the carapax and appendages are more numerous and much more acute than in *L. maia*, and the marginal spines of the carapax are not very much larger than the dorsal. There are only two adults, both females, in the collection, and these differ remarkably from each other, and from three very young specimens, in the number and length of the spines upon the carapax and legs.

In the larger specimen the carapax, excluding the rostrum and spines, is about nine tenths as broad as long, with a conspicuous sinus in the middle of the posterior margin. The rostrum is very short, with an acute central spine scarcely as long as the eye-stalks and with a somewhat shorter lateral spine arising either side its base and directed upward and outward. The gastric region is swollen and very high, separated from the cardiac by a very deep depression, and armed with a pair of small spines just back of the lateral spines of the rostrum, and back of these on the highest part of the region with two widely separated pairs of much larger spines, while either side there is a small spine opposite the large hepatic spine, between which and the obtusely spiniform external angle of the orbit there are two spinigerous angular prominences in the antero-lateral margin. There is a distinct notch in the antero-lateral margin at the cervical suture, but back of this the margin is regularly arcuate to the middle of the posterior margin, and is armed with about thirteen stout spines, of which the larger are about as large as the hepatic spines. The branchial region is considerably convex, and armed, in addition to those upon the margin, with about ten large spines, between which there are a considerable number of low obtuse spines or tubercles. The cardiac region is separated from the branchial each side by a deep sulcus, is prominent and armed with two pairs of large spines, and back of these with a single one in the middle line.

The eyes, antennulæ, antennæ, and the exposed parts of the oral appendages are very nearly as in *L. maia.* The chelipeds are nearly equal in length, but the right is much stouter than the left, are armed with comparatively few and small spines, and the digits of the chelæ are about two thirds of the entire length of the chela, slender, tapering, and strongly curved. The ambulatory legs are very long, those of the third pair being nearly three times as long as the breadth of the carapax excluding spines. The ischial, meral, and carpal segments are armed with only a very few scattered and very small spines, the meral segments in the first and second pairs are almost entirely unarmed except a few small spines or teeth along the upper edges, but the propodi, which are slender and fully as long as the corresponding meri, are armed along the edges with more numerous and very sharp but small spines. The dactyli are about half to considerably more than half the length of the corresponding propodi, slightly curved, acute, and, except near the tips, armed with small and acute spines.

The plates of the second somite of the abdomen are armed with numerous spines projecting backward and upward, and of which those upon the middle plate are longer than those upon the lateral. The plates of the succeeding somites of the abdomen are very unequally developed, the plates of the left hand side of the third, fourth, and fifth somites being greatly developed at the expense of the corresponding plates of the opposite side, so that the outer edge of the left side of the fifth segment lies beneath the bases of the cheliped and first ambulatory leg of the right side, and the small semicircular telson is beneath or a very little in front of the base of the second ambulatory leg of the right side.

In the smaller of the adult specimens (Pl. I. fig. 1) the carapax, excluding rostrum and spines, is proportionally narrower than in the larger specimen, being about eight tenths as broad as long, and the spines upon the carapax, abdomen, and appendages are much longer and more numerous, the additional spines appearing between the large ones corresponding to the spines, or in place of the tubercles, on the larger specimen. The rostral spine and the spines at its base are absolutely more than twice as long as in the larger specimen and more slender, and about the same proportion holds for all the principal spines of the carapax. The external angle of the orbit projects in a spine but little shorter than the eye-stalk, and back of it there are two nearly as large spines on the antero-lateral margin in place of the two angular prominences of the larger specimen. The large hepatic spine and the thirteen large marginal spines back of the cervical suture are most of them but little smaller than the rostral spine, are directed more upward than outward, and there are nearly as many more additional smaller spines alternating with the larger. There is a conspicuous additional spine in the middle of the gastric region, and numerous additional small spines on other parts of the carapax.

The chelipeds and ambulatory legs have about the same proportions as in the larger specimen, but are armed with very numerous acute spines, many of which are of large size. The spines upon the second somite of the abdomen are more numerous, and the larger ones much longer and more slender than in the larger specimen.

The small specimens are all immature, with the carapax excluding the rostrum and spines less than 13 mm. in length, and differ so much from the adults that they might readily be mistaken for a distinct species. These small specimens differ considerably in size, but are all essentially alike. The smallest and most perfect one is from the U. S. Fish Commission dredgings off Martha's Vineyard. In this specimen (Pl. I. figs. 2, 2^a) the carapax excluding the rostrum and spines is only 12.6 mm. in length and scarcely more than seven tenths as broad as long, but all three of the rostral spines and several spines of the carapax proper are more than half as long as the carapax. The spines are much fewer in number than in either of the adult specimens, very slender and acute, and those at the base of the rostrum are just about as large as the rostrum itself. The gastric region is proportionally very much larger than in the adults, but is high and separated from the cardiac region by a deep sulcus, as in them, and is armed with six slender spines, — two pairs on the highest part of the region, of which the anterior pair are almost as long as the rostrum, but the posterior considerably shorter, and a still smaller lateral spine each side. There are two pairs of slender spines on the anterior part of the cardiac region, the anterior a little longer and the posterior a little shorter than the posterior gastric spines. The single hepatic spine each side is nearly as long as the rostrum. The external angle of the orbit projects forward in a long and slender spine, back of which are two smaller spines on the antero-lateral margin. There are about twelve slender spines on the lateral and posterior margin back of the cervical suture each side, but they are all small compared with the other spines of the carapax and about half of them are inconspicuous, and above these on either branchial region there are six much larger spines, of which two near the middle of the region are as long as the posterior gastric, but the others considerably shorter.

The eye-stalks and eyes are small and proportionally but little larger than in the adult, but there are two or three sharp spines projecting in front over the eye in place of some inconspicuous tubercles in the adults. The antennulæ, antennæ, and the exposed parts of the oral appendages, are nearly as in the adults.

The chelipeds are nearly as unequal as in the adults, and are armed with very much longer and more slender spines, several of those upon the distal part of the merus and upon the carpus being longer than the carpus itself. The ambulatory legs have about the same proportions as in the adults, but the spines with which they are armed are fully as long as those upon the chelipeds, the longer ones, as in the chelipeds, being upon the distal parts of the meri and upon the carpi.

The abdomen is *symmetrical*. The second somite is made up of three calcified and spiny plates, nearly as in the adult female. The third, fourth, and fifth somites are soft, scarcely at all calcified, and show no distinct division into somites. The sixth is small and sunken for its whole length in the proximal somites, while the seventh is still smaller and rounded at the extremity.

Four of the five specimens seen give the following measurements : —

Station	1029	305	329	326
Sex	Young.	Young.	♀	♀
Length of carapax including rostrum and posterior spines	17.5	25+	115	139
Length of carapax excluding rostrum and posterior spines	9.1	12.6	90	123
Breadth of carapax between tips of hepatic spines,	13.5	18+	57	64
" " " " branchial spines,	13.0	18+	87	117
Greatest breadth of carapax excluding spines	6.6	9.0	77	110
Length of rostrum	7.3	9+	17	8
" spines at base of rostrum	7.4	11.5	16	7
" anterior gastric spines	7.0	10.5	12	5
" " cardiac	6.3	8.0	10	5
" right cheliped	15.0	19.0	126	171
" " chela	6.1	8.5	55	66
Breadth of " "	1.9	2.5	18	25
Length of dactylus of right chela	3.5	5.0	35	44
" left cheliped	15.0	20.0	126	167
" " chela	6.0	8.8	50	62
Breadth of "	1.5	1.9	14	19
Length of dactylus of left chela	3.8	5.5	36	44+
" first ambulatory leg	18.5	30.0	220	270
" second " "	19.5	31.5	245	310
" third " "	19.5	32.0	260	320
Greatest expanse of ambulatory legs	43.0	65.0	560	720

Station.	N. Lat.	W. Long.	Fathoms.
305	41° 33′ 15″	65° 51′ 25″	810
326	33° 42′ 15″	76° 0′ 50″	464
329	34° 39′ 40″	75° 14′ 40″	603

Also taken by the U. S. Fish Commission, off Martha's Vineyard, in 1881. Stations 1028 and 1029, 410 and 458 fathoms; one young specimen in each case.

PAGURIDEA.

PAGURIDÆ.

Eupagurus Kröyeri Stimpson.

Eupagurus Kröyeri Stimpson, Ann. Lyceum Nat. Hist. New York, VII. p. 89 (43), 1859.

Smith, Trans. Conn. Acad., III. p. 28, 1874 ; Ibid., V. p. 48 ; Proc. National Mus., Washington, III. p. 428, 1881.

Eupagurus pubescens Kröyer, in Gaimard, Voyages en Scandinavie, Pl. II. fig. 1, 1849 (*non* Kröyer, Naturh. Tidssk., II. p. 251, 1839).

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
303	41° 34′ 30″	65° 54′ 30″	306	6
306	41° 32′ 50″	65° 55′ 0″	524	4
311	39° 59′ 30″	70° 12′ 0″	143	2 in *Epizoanthus.*

Nearly all the specimens I have seen from deep water off the Southern coast of New England are small, and the great majority of them were inhabiting carcinœcia overgrown by or composed of *Epizoanthus Americanus* Verrill.

Eupagurus politus, sp. nov.

Plate II. Fig. 5.

The carapax is not suddenly narrowed at the bases of the antennæ, where the breadth is equal to the length in front of the cervical suture, and not rostrated, the median lobe of the front being broadly rounded and not projecting as far forward as the external angles of the orbital sinuses, which are acute and each usually armed with a short spine.

The eye-stalks, including the eyes, are nearly four fifths as long as the breadth of the carapax in front, stout, and expanded at the very large black eyes, which are terminal, not oblique, compressed vertically, and broader than half the length of the stalks. The ophthalmic scales are small, narrow, and spiniform at the tips.

The peduncle of the antenna is about as long as the breadth of the carapax in front, and the ultimate segment about a third longer than the penultimate. The upper flagellum is much longer than the ultimate segment of the peduncle, while the lower is only about half as long as the upper, slender, and composed of ten to twelve segments. The peduncle of the antenna reaches slightly beyond the eye. The acicle is slender, slightly curved, and reaches to the tip of the peduncle, and inside its base there is a minute tooth, while outside there is a straight spine toothed or spined along its inner edge, acute at the tip and half as long as the acicle itself. The flagellum is nearly naked, and about three times as long as the carapax.

The exposed parts of the oral appendages are very nearly as in *E. bernhardus*.

The chelipeds are longer, much narrower, and more nearly equal in size than in *E. bernhardus*, and, as in that species, are almost entirely naked, but beset with numerous tubercles and low spines. The right cheliped is about as long as the body from the front of the carapax to the tip of the abdomen. The merus and carpus are subequal in length, while the chela is about once and a half as long as the carpus. The carpus and chela are rounded above and armed with numerous tubercles, which are smaller and more crowded on the chela than on the carpus, but the surface between the tubercles is smooth and polished. The dorsal surface of the carpus is limited along the inner edge by a sharp angle armed with a double line of tubercles, while the outer edge is rounded. The chela is very little wider than the carpus, and is narrowed from near the base to the tips of the digits, and both edges are rounded. The digits are rather slender, about half as long as the entire chela, slightly gaping, with acute and strongly incurved chitinous tips, and the prehensile edges armed with a very few obtuse tuberculiform teeth. The left chela is much more slender than the right, but reaches to or a little by the base of its dactylus. The carpus is slender, higher than broad, only slightly expanded distally, and with the narrow dorsal surface flattened and margined either side with a single line of spiniform tubercles. The chela is about a third longer than the carpus, slender, about two and a half times as long as broad, and the dactylus about two thirds the entire length. The dorsal and outer surface is tuberculose, and a low obtuse ridge extends from near the middle of the base along the propodal digit, which tapers from the base to the tip, while the dactylus is smooth except for a few fascicles of setæ, more slender than the propodal digit, and tapered only near the tip. The chitinous tips of the digits are slender, acute, and strongly incurved, and the prehensile edges are sharp, and armed with a closely set series of slender spines or setæ.

The ambulatory legs reach considerably beyond the right cheliped, and the second pair reach to the tips of the first pair. In both pairs the meri and propodi are approximately equal in length and longer than the carpi, while the dactyli are about once and a half as long as the propodi, slender, strongly curved, and distally strongly twisted. The two posterior pairs of thoracic legs and the abdominal appendages are very nearly as in *E. bernhardus*.

In life the general color of the exposed parts is pale orange, the tips of the chelæ and of the ambulatory legs white, the eyes black.

The eggs are very large, and few in number as compared with the ordinary species of the genus, being 1.0 to 1.1 mm. in diameter in alcoholic specimens, while in *E. bernhardus* they are only 0.45 to 0.50 mm. in diameter.

Three specimens give the following measurements : —

Station	306	309	309
Sex	♀	♂	♂
Length from front of carapax to tip of abdomen	25.0 mm.	40.0 mm.	50.0 mm.
" of carapax along median line . .	10.0	16.0	21.0

Breadth of carapax in front	5.5 mm.	8.6 mm.	11.0 mm.
Length of eye-stalks	4.7	6.2	7.8
Greatest diameter of eye	2.7	3.5	4.1
Length of right cheliped	30.0	40.0	56.0
" carpus	7.3	11.3	14.5
" chela	12.0	16.0	22.7
Breadth of chela	5.8	8.3	11.0
Length of dactylus	6.1	9.1	11.9
" left cheliped	25.0	37.0	48.0
" carpus	6.1	10.0	12.0
" chela	9.2	13.5	17.5
Breadth of chela	4.0	5.8	7.5
Length of dactylus	5.8	8.8	11.2
" first ambulatory leg, right side	36.0		67.0
" propodus	7.6		14.5
" dactylus	11.5		22.0
" second ambulatory leg, right side	38.0	54.0	73.0
" propodus	8.8	12.0	16.0
" dactylus	13.0	17.0	23.0

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	40° 11′ 40″	68° 22′ 0″	304	3
310	39° 59′ 16″	70° 18′ 30″	260	2
336	38° 21′ 50″	73° 32′ 0″	197	5

It has also been taken, and in great abundance, by the U. S. Fish Commission, off Martha's Vineyard and off the Capes of the Delaware, in 65 to 365 fathoms, and is the species which I have referred to, in Proc. National Mus., Washington, III. p. 428, 1881, as "*Eupagurus*, sp."

CATAPAGURUS A. M.-Edwards.

Catapagurus A. M.-Edwards, Bull. Mus. Comp. Zoöl., VIII. p. 46, 1880 (Dec. 29).
Hemipagurus Smith, Ann. Mag. Nat. Hist., 5th ser., VII. p. 143, Feb. 1881; Proc. National Mus., Washington, III. p. 422, 1881.

I have no doubt that my genus is synonymous with that of Milne-Edwards as indicated above, but I am quite unable to tell from the description alone whether one of my species is synonymous with the single species, *C. Sharreri*, described by Milne-Edwards. *C. Sharreri* agrees more nearly in size with *H. socialis* than *H. gracilis*, but will very likely prove to be distinct from either, and until this can be determined satisfactorily, it seems best to refer both my species to *Catapagurus*.

The genus differs from *Spiropagurus* Stimpson in the form and position of the sexual appendage (formed by the permanent extrusion of a portion of the vas deferens) of the last thoracic somite of the male, which arises from the *right* coxa, and is curved in one plane round the right side of the abdomen; while in *Spiropagurus* the appendage arises from the *left* coxa, and is spirally curved.

The carapax is short and broad, and the anterior margin is obtuse, and does not wholly cover the ophthalmic somite between the eyes. The portion in front of the cervical suture is indurated, but all the rest of the carapax is very soft and membranaceous, without any distinct induration along the cardiaco-branchial suture. The ophthalmic scales are well developed. The eye-stalks are short and the cornea expanded. The antennulæ, antennæ, and oral appendages are similar to those in *Eupagurus;* the exopods of all the maxillipeds are, however, proportionally much longer than in that genus. There are eleven pairs of phyllobranchiæ, arranged as in *Eupagurus bernhardus*, but the two anterior pairs connected with the external maxillipeds are very small, and composed of a few flattened papillæ. The chelipeds are slender and unequal. The first and second pairs of ambulatory legs are long, and have slender, compressed, and ciliated or setigerous dactyli; the third pair are only imperfectly subcheliform.

In the male, the second, third, and fourth somites of the abdomen bear small appendages upon the left side, as in most of the allied genera, but the fifth somite is destitute of an appendage; in the female, the appendages of the second, third, and fourth somites are biramous and ovigerous, and there is usually a rudimentary uniramous appendage upon the fifth somite, as in the allied genera.* The uropods are very nearly or quite symmetrical, the rami of the right appendage being very nearly or quite as large as that of the left. The telson is bilobed at the extremity.

As might be expected, the unsymmetrical development of the external sexual appendages of the males of the two species here described corresponds to a like unsymmetrical development of the internal sexual organs, and the following incomplete observations, made on ordinary alcoholic specimens in which the abdominal viscera are not sufficiently well preserved for a full anatomical or histological investigation, appear of sufficient importance to notice here, especially as nothing appears to be known of the internal structure of either species of *Spiropagurus.*

The right testis and vas deferens are much larger than the left. The lower part of the right vas deferens, in all the adults examined, is much more dilated than the left, and is filled (as is also the external part of the duct) with very large spermatophores of peculiar form. The left vas deferens is slender, much as in *Eupagurus bernhardus*, terminates in a small opening in the left coxa of the last thoracic somite, as in ordinary Paguroids, and contains spermatophores somewhat similar in form and size to those of *Eupagurus bernhardus.* In alcoholic specimens of *C. socialis* the spermatophores from the left vas deferens are approximately 0.16 mm. long and 0.035 mm. broad, with a slender neck about a third of the entire length, and a very thin and delicate lamella for a base. The spermatophores from the right vas deferens are over 2 mm. in total length; the body itself is oval, approximately 0.40 mm. long and a third as broad; at one end it terminates in a very long and slender process, two or three times as long as the body; at the other end there is a similar but slightly stouter process, a little longer than the body, and expanding at its tip into a broad and very delicate lamella, approximately 0.35 mm. long by 0.20 mm. broad.

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* In many of the best preserved and most perfect females of *C. socialis* examined I can find no trace whatever of this appendage of the fifth somite, while in others it is very easily seen.

Catapagurus socialis.

Hemipagurus socialis Smith, Proc. National Mus., Washington, III. p. 423, 1881.

Male. — The part of the carapax in front of the cervical suture is about a fifth broader than long, with the sides nearly parallel; the front margin sinuous, curving slightly forward in the middle and each side between the eye-stalks and the peduncles of the antennæ, the middle lobe thus formed being scarcely more prominent than the lateral lobes, each of which is armed with a minute spine, projecting forward just inside of the peduncle of the antenna; between these spines the edge of the front is upturned in a sharp marginal carina, which terminates each side in the spines themselves. The dorsal surface of this part of the carapax is convex in both directions, the protogastric lobes are protuberant and well marked, and nearly the whole surface is roughened and more or less tuberculose, with transverse scabrous elevations, which give rise to numerous hairs. The branchial regions are slightly swollen, so that the breadth of the carapax posteriorly is greater than in front. All the portions back of the cervical suture are smooth and membranaceous.

The eye-stalks are about half as long as the carapax in front of the cervical suture, flattened and expanded distally, where they are about three fourths as broad as long. The eye itself is black, and the cornea extends round either side so as to be crescent-shaped as seen from above. The ophthalmic scales are less than half as long as the eye-stalks, narrow, triangular, and acute.

The first and second segments of the peduncle of the antennula are subequal in length, and the ultimate segment nearly once and a half as long as the penultimate, and almost as long as the eye-stalks. The superior or major flagellum is nearly as long as the ultimate segment of the peduncle; the thick, ciliated basal portion consists of about fourteen segments, and the slender terminal portion, which is nearly once and a half as long as the basal, of about five very slender and subequal segments. The minor flagellum is about two thirds as long as the major, and composed of about eight segments. The peduncle of the antenna reaches by the eye nearly the length of the last segment, which is about as long as the greatest diameter of the eye. The aciele is slender, acute, and slightly longer than the last segment of the peduncle. The flagellum reaches beyond the tips of the ambulatory legs.

The chelipeds are slender and very nearly equal in length, but the right is very much stouter than the left. In the right cheliped the merus and carpus are subequal in length, together nearly twice as long as the carapax, and both are rough and obscurely spinous, the spines being most conspicuous on the edges of the upper surface of the carpus, which is fully three times as long as broad, flattened above, and angular, but not distinctly carinated along either side. The chela is not far from twice as long as the carpus, nearly three times as long as broad, compressed vertically, evenly rounded, smooth and nearly naked above, but clothed with long, soft hair beneath; the digits are longitudinal, not gaping, and the dactylus is about two thirds as long as the basal portion of the propodus, and its prehensile edge is armed with a broad tooth near the middle. In the left cheliped the merus and carpus are similar to those of the right, but much more slender and a little longer; the carpus is about six times as long as broad, and the edges of the upper surface are rather more sharply angular than in the right; the chela is shorter than the right, but very slender, smooth, and nearly naked; the digits are similar, longitudinal, slightly longer than the basal portion of the chela, compressed, slightly curved downward toward the tips, but the prehensile edges straight and very minutely serrate.

The ambulatory legs are very nearly equal in length, and slightly overreach the chelipeds; the merus is about as long as the left chela, and roughened with small spines on the upper and under edges; the propodus is shorter than the merus, compressed, smooth, and ciliated along the edges; the dactylus is a little longer in the second than in the first pair, but in both shorter than the propodus, very strongly compressed, very slightly twisted, about ten times as long as broad, and thickly ciliated along both edges, except for a short distance along the lower edge near the tip.

The *female* is smaller than the male, and has proportionally shorter ambulatory legs, and chelipeds very much shorter and much more alike. The right chela is only about a third longer than the carpus, little more than a third as broad as long, and the digits are slender and nearly as long as the basal portion. The left cheliped is proportionally stouter than in the male, and thus approximates to the right; the chela itself is scarcely more than a third longer than the carpus. The ambulatory legs overreach the chelipeds by nearly or quite the full length of the dactyli, but all the segments have very nearly the same relative proportions as in the male.

The eggs are few in number and very large, being about a millimeter in diameter in alcoholic specimens.

In young males the chelipeds and ambulatory legs are similar to those of the female.

Two specimens from Station 314 give the following measurements:—

Sex	♂	♀
Length from front of carapax to tip of abdomen . .	18.0 mm.	15.0 mm.
" of eye-stalks	2.8	2.5

Greatest diameter of eye	2.0 mm.	1.6 mm.
Length of right cheliped	30.0	15.0
" chela	11.5	5.2
Breadth of propodus	4.4	1.9
Length of left cheliped	26.0	14.5
" chela	9.5	5.0
Breadth of propodus	2.0	1.2
Length of first ambulatory leg, right side	32.0	19.5

The carcinœcium is very rarely a naked gastropod shell; in most of the specimens seen it is either built up by a colony of *Epizoanthus Americanus*, or is made up in a somewhat similar way by the single polyp of *Adamsia sociabilis* Verrill, the base secreted by the *Adamsia* being expanded on either side and united below so as to enclose the crab in a broadly conical cavity, with only a slight spiral curvature. The nuclei about which these polypean carcinœcia are formed are of various origins; the majority of the *Adamsia* carcinœcia appear to have been built upon fragments of pteropod shells, in some cases upon bits of worm-tubes, in one case upon the entire shell of a *Cadulus*, the greater part of the shell being left protruding from the base of the polyp. In the carcinœcia formed by *Epizoanthus* the nucleus seems usually to have been absorbed, so that nothing is left distinguishable from the colony of polyps itself. In some cases the *Adamsia* has completely overgrown a small *Epizoanthus* carcinœcium, so that when the *Adamsia* is removed a perfect *Epizoanthus* carcinœcium is found beneath as a nucleus. The carcinœcium of this species, and of *C. gracilis* as well, does not cover the animal to the same extent as is usual in the species of *Eupagurus*, the anterior part of the carapax being apparently constantly exposed, and its induration fitting the animal for such exposure. The *Epizoanthus* carcinœcia are, however, very often disproportionately large for the crabs inhabiting them, having grown out either side until they are several times broader than long. In spite of these often enormous carcinœcia, both species of the genus probably swim about by means of the ciliated dactyli of the ambulatory legs, as *Spiropagurus spiriger* has been observed to do by Stimpson (Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 248 (86), 1859).

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
311	39° 59′ 30″	70° 12′ 0″	143	6
313	32° 31′ 50″	78° 45′ 0″	75	2
314	32° 24′ 0″	78° 44′ 0″	142	1000±
315	32° 18′ 20″	78° 43′ 0″	225	4
316	32° 7′ 0″	78° 37′ 30″	229	1
327	34° 0′ 30″	76° 10′ 30″	178	8
344	40° 1′ 0″	70° 58′ 0″	129	40±
345	40° 10′ 15″	71° 4′ 30″	71	5

This species was taken in great abundance, in 51 to 250 fathoms, off Martha's Vineyard, by the U. S. Fish Commission, in 1880 and 1881.

Catapagurus gracilis.

Hemipagurus gracilis SMITH, Proc. National Mus., Washington, III. p. 426, 1881.

This is a smaller and more slender species than the last, and is readily distinguished from it by the smooth carapax, the longer and more slender eye-stalks, the long and acicular ophthalmic scales, and by the narrow dactyli of the ambulatory legs being longer than the corresponding propodi.

Male. — The carapax in front of the cervical suture is flat, smooth, nearly naked, and scarcely at all areolated. The anterior margin is rather more strongly sinuous than in *C. socialis*, and the lateral lobes are slightly angular and each is tipped with a minute spine, as in that species, but the marginal carina between these spines is much less distinct.

The eye-stalks are more than half as long as the carapax in front of the cervical suture, flattened and expanded distally, but only about half as broad as long. The eyes themselves are as in *C. socialis*. The ophthalmic scales are more than half as long as the eye-stalks, and are acicular and regularly acute.

The ultimate segment of the peduncle of the antennula is as long as the eye-stalk and nearly twice as long as the penultimate segment. The major flagellum is as long as the ultimate segment of the peduncle, the basal portion of about eight segments, the terminal portion three times as long and of about five subequal and very slender segments. The minor flagellum is about half as long as the major, and composed of about six segments. The antennæ are very much as in *C. socialis*.

The chelipeds are nearly equal in length and similar to those of *C. socialis*, but in the right cheliped the inner edge of the upper surface of the carpus is angular, and armed with a regular series of twelve to eighteen small spines, while the outer edge is rounded and unarmed ; and the prehensile edge of the dactylus is armed with two irregular and indistinct teeth, corresponding with two irregular emarginations in the edge of the digital portion of the propodus. In the left cheliped the outer edge of the upper surface of the carpus is slightly rounded and scarcely at all spinulous, while the inner edge is armed as in the right cheliped. The left chela differs from that of *C. socialis*, in having the digital portion of the propodus considerably stouter than the dactylus, particularly toward the base.

The ambulatory legs are proportionally as long as in *C. socialis*, but more slender ; in both pairs the dactylus is longer than the propodus, curved slightly near the tip, about sixteen times as long as broad, sparsely ciliated along the upper edge, and very slightly setigerous along the lower.

The *female* differs from the male as in *C. socialis*, but to a very much less extent, the chelipeds and ambulatory legs being only a little shorter than in the male, and the right cheliped only a little less stout and a little more like the left than in the male.

The eggs are few and nearly as large as in *C. socialis*.

The carcinœcia are similar to those of the last species.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
344	40° 1′ 0″	70° 58′ 0″	129	1
345	40° 10′ 15″	71° 4′ 30″	71	3

Also taken by the U. S. Fish Commission, in 51 to 155 fathoms, off Martha's Vineyard, in 1880 and 1881.

Two specimens from Fish Commission Station 874, 85 fathoms, give the following measurements : —

Sex	♂	♀
Length, from front of carapax to tip of abdomen	12.0 mm.	11.2 mm.
Length of eye-stalk	1.6	1.5
Greatest diameter of eye	1.1	0.9
Length of right cheliped	15.2	11.2
" chela	6.0	4.4
Breadth of chela	2.4	1.8
Length of left cheliped	13.6	10.0
" chela	5.0	3.6
Breadth of chela	1.1	1.0
Length of first ambulatory leg, right side	16.1	12.8

PARAPAGURIDÆ.

The genus *Parapagurus* differs so widely from all other Paguridea in possessing trichobranchiæ instead of phyllobranchiæ, that it ought, undoubtedly, to be separated as a distinct family on this character alone.

Parapagurus pilosimanus Smith.*

Trans. Conn. Acad., V. p. 51, 1879 ; Proc. National Mus., Washington, III. p. 428, 1881.

Plate II. Figs. 4-4^1.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
306	41° 32′ 50″	65° 55′ 0″	524	1 young.
309	40° 11′ 40″	68° 22′ 0″	304	4
322	33° 10′ 0″	76° 32′ 15″	362	2 ♂

This species has also been taken, and in considerable abundance, by the U. S. Fish Commission, in deep water off Martha's Vineyard. At Station

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* A. Milne-Edwards in a recent report on the explorations of the "Travailleur," in the Comptes-Rendus of the Academy of Sciences, Paris, Dec. 1881 (Ann. Mag. Nat. Hist., 5th ser., IX. p. 42, 1882), states that his *Eupagurus Jacobii* from the "Blake" dredgings (Bull. Mus. Comp. Zoöl., VIII. p. 42, 1880) is identical with this species, of which specimens were sent to him last June.

947, 312 fathoms, three hundred and ninety-three specimens, nearly all adults and many of them very large, were taken at one haul of the trawl.

The carcinœcia of all the specimens seen are formed by colonies of *Epizoanthus paguriphilus* Verrill, which at first invest spiral shells which are finally absorbed by the basal cœnenchyma of the growing polyps.

GALATHEIDÆ.

Galacantha rostrata A. M.-Edwards.

Bull. Mus. Comp. Zoöl., VIII. p. 52, 1880.

Plate IX. Figs. 2, 2ª.

Station 340, N. Lat. 39° 25′ 30″, W. Long. 70° 58′ 40″, 1394 fathoms ; and Station 341, N. Lat. 39° 38′ 20″, W. Long. 70° 56′, 1241 fathoms ; two males, which give the following measurements : —

Station	341	340
Sex	♂	♂
Length from tip of rostrum to tip of telson	75.0 mm.	62.0 mm.
" of carapax to bases of rostral spines	34.5	28.8
Greatest breadth excluding spines	27.0	23.2
" " including "	31.5	26.7
Length of rostrum above its lateral spines	7.8	8.0
" gastric spine	7.7	7.8
Greatest breadth of abdomen, third somite	24.2	24.0
" diameter of eye	3.0	2.4
Length of cheliped	53.5	44.0
" chela	21.5	16.7
" dactylus	13.0	10.3
" first ambulatory leg	65.0	53.0
" posterior leg	39.0	31.0

MUNIDOPSIS Whiteaves.

Munidopsis Whiteaves, Amer. Jour. Sci., 3d ser., VII. p. 212, 1874.
Galathodes A. M.-Edwards, Bull. Mus. Comp. Zoöl., VIII. p. 53, 1880.

Munidopsis curvirostra Whiteaves.

Amer. Jour. Sci., 3d. ser., VII. p. 212, 1874 ; Report on further Deep-sea Dredging Operations in the Gulf of St. Lawrence [in 1873], p. 17, 1874.

Plate VIII. Figs. 2, 3, 3ª.

Station 325, N. Lat. 33° 35′ 20″, W. Long. 76°, 647 fathoms, one small male, which gives the following measurements : —

Length from tip of rostrum to tip of telson	16.0 mm.
" of carapax	10.4
Greatest breadth of carapax	5.2
Diameter of eye	0.8
Length of cheliped	15.0
" chela	5.9

I have compared this specimen with the original specimens from the Gulf of St. Lawrence described by Whiteaves, and find no differences of any importance whatever. The species is perhaps identical with some one of the ten species of *Galathodes* described by Milne-Edwards, but with which, if with any, it seems impossible to determine from the descriptions alone.

Munida, sp. indet.

Munida Caribæa? SMITH, Proc. National Mus., Washington, III. p. 428, 1881.

Plate X. Fig. 1.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
311	39° 59′ 30″	70° 12′ 0″	143	1
314	32° 24′ 0″	78° 44′ 0″	142	50±
315	32° 18′ 20″	78° 43′ 0″	225	1
333	35° 45′ 25″	74° 50′ 30″	65	100±
335	38° 22′ 25″	73° 33′ 40″	89	31
336	38° 21′ 50″	73° 32′ 0″	197	6
344	40° 1′ 0″	70° 58′ 0″	129	1

Also taken in great abundance in the U. S. Fish Commission dredgings off Martha's Vineyard, in 1880 and 1881, in 65 to 200 fathoms.

This species will probably prove identical with one of the eleven species enumerated by A. Milne-Edwards in his report on the "Blake" crustacea from the West Indies, but with which one it is not possible to tell from the descriptions alone. Before the publication of Milne-Edwards's report I referred this species doubtfully, as indicated above, to *Munida Caribæa* of Stimpson, described from a single very small specimen, but it is probably not the species referred to the *Caribæa* by Milne-Edwards. It is now impossible to tell with certainty to which of the numerous Caribbean species Stimpson's really belongs, but it is perhaps best to restrict it to the one called *Caribæa* by Milne-Edwards, whatever that may be, although he gives no description whatever.

MACRURA.

ERYONTIDÆ.

Pentacheles sculptus.

Plates III. and IV.

Polycheles sculptus SMITH, Ann. Mag. Nat. Hist., London, 5th ser., V. p. 269, April, 1880; Proc. National Mus., Washington, II., 1879, p. 345, Pl. VII., 1880.

Pentacheles spinosus A. M.-EDWARDS, Bull. Mus. Comp. Zoöl., VIII. p. 66, December, 1880.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
325	33° 35′ 20″	76° 0′ 0″	647	1 young, 44 mm. long.
326	33° 24′ 15″	76° 0′ 50″	464	1 ♂, 2 ♀
329	34° 39′ 40″	75° 14′ 40″	603	2 ♂

This species was first described from a single imperfect specimen taken by a Gloucester fisherman, off the coast of Nova Scotia, N. Lat. 43° 10′, W. Long. 61° 20′, in 250 fathoms, so that the specimens recorded above, and a large female with eggs, taken, Nov. 16, 1880, off the mouth of Chesapeake Bay, N. Lat. 37° 24′, W. Long. 74° 17′, 300 fathoms, Station 898, by Lieut. Tanner, on the U. S. Fish Commission Steamer "Fish-Hawk," afford an opportunity for a more complete description than that originally given.

The sides of the carapax are nearly parallel posteriorly, but arcuately convergent anteriorly, and the greatest breadth is just in front of the cervical suture, and is about three fourths of the length along the median line. As seen from above, the anterior margin is concave in outline, so that the acute and spiniform lateral angles are much in advance of the rostrum, which is armed with two spines close together and projecting obliquely upward and forward. About a third of the space between the median line and the lateral angle each side is occupied by a very deep orbital sinus nearly parallel with the lateral margin, considerably deeper than broad, somewhat narrowed and evenly rounded posteriorly, and completely filled by the large ophthalmic lobe. On the inner side of this sinus the frontal margin projects in a small spiniform tooth, but outside the margin is unarmed and curves regularly to the lateral angle. Just behind the orbital sinus there is a smooth and evenly curved depression in the surface of the carapax exposing a small area on the posterior part of the ophthalmic lobe, more fully described beyond. The cervical suture divides the dorsal surface of the carapax into two pretty nearly equal portions, and is deep and conspicuous, but is indicated in the lateral margin, each side, by a slight emargination only, which is scarcely deeper than the emargination between the anterior and posterior lobes of the hepatic region. The lateral margin is armed, on the anterior lobe of the hepatic region, with (including the anterior angle) six, or rarely only five, small and slender spiniform teeth directed forward, and on the posterior lobe with three more. The lateral margin, behind the cervical suture, is armed with six to eight similar teeth, which become successively more remote posteriorly. There is a slight median carina extending the whole length of the carapax, and armed, behind the two rostral spines, first with a single small spine directed forward, then with two side by side and very close together, then with one, then with two on the posterior edge of the cervical suture, then with two more, and finally with two somewhat larger and more widely separated spines projecting forward from the anterior edge of the broad and prominently raised posterior margin. In front of the cervical suture there is an irregular longitudinal dorso-lateral line of five minute spines each side, and back of these a single spine each side on the posterior edge of the cervical suture. Extending from the posterior margin nearly to the cervical suture, there is a sharp sublateral carina parallel to the lateral margin, about a third of the way from it to the median carina, and armed with five or six small spines.

The ventral regions of the carapax (Pl. IV. fig. 1) are inflected each side at a very acute angle with the dorsal surface, and, the sternum being narrow, the ventral regions are very broad. The ventral region each side is divided longitudinally into three approximately equal parts by two prominent carinæ; the outer carina (marking the pleurotergal suture?) extends from the anterior margin at the base of the antenna, in a slightly sinuous line, toward the postero-lateral margin of the carapax; the anterior half is very prominent, and armed with small spines directed outward, while the posterior half is much less conspicuous, unarmed, and disappears entirely before reaching the posterior angle of the carapax. The inner carina extends along the branchial region from near the base of the first leg quite to the postero-lateral angle of the carapax; the extreme anterior portion is not prominent, but from opposite the third leg posteriorly it is very prominent, acute, and armed with ten to fifteen sharp spines. The outer of the three longitudinal regions thus marked out is divided transversely by the cervical suture, and the anterior portion (subhepatic region) is divided transversely into an anterior and a posterior lobe by a groove nearly or quite as conspicuous as the cervical. In the frontal margin of this anterior lobe, and near its inner side, there is a deep sinus corresponding to the orbital sinus of the dorsal surface, but not quite as wide, and open nearly to the dorsal surface, except where it is crossed by a protuberance from the ventral portion of the ophthalmic lobe.

On the upper surface of the carapax, the orbital sinus, each side, is completely filled by the dorsal part of the ophthalmic lobe, of which the anterior margin is slightly concave in outline and continuous with the anterior margin of the carapax, but has a small tubercle near the middle. The dorsal surface of the lobe is smooth, calcareous, and opaque, and on a level with the adjacent surface of the carapax except posteriorly, where a small oval area of the extremity of the lobe is exposed by a depression in the carapax. This oval area is thin, semitranslucent, and not calcareous, and has every appearance of being a true corneal area, although I am unable to detect any evidence of facets. The carapax along the margins of the sinus is in close contact with the ophthalmic lobe. From the lower portion of each ophthalmic lobe there is an elongated cylindrical and somewhat conical, but obtuse and pointed protuberance, of which the base rests in a transverse groove in the base of the antenna, while the terminal portion extends well across the open ventral side of the orbital sinus. Upon the obtuse extremity of this protuberance there is a nearly circular area similar to the cornea-like area at the posterior extremity of the dorsal part of the lobe.

The peduncles of the antennulæ are very stout, being stouter even than the peduncles of the antennæ. The basal portion of the proximal segment is longer than the two distal segments, is armed on the distal portion of the outer margin with two spiniform teeth, and the inner side is broadly expanded and prolonged into an acute scalelike appendage upturned and densely ciliated along the inner margin, and extending considerably beyond the distal segment and nearly as far as the tip of the antennal scale. The second and third segments are subcylindrical, and, as seen from above, are each about as broad as long, the second being somewhat larger than the third. The inner or major flagellum is about as long as the carapax. The minor flagellum is about as long as the peduncle of the antenna, about half as thick as the base of the major flagellum, of nearly uniform thickness for three fourths its length, then tapers rapidly to a very slender tip, and is thickly ciliated along the inner margin distally.

The first three segments of the peduncle of the antenna are very short, the three together being scarcely longer than the fifth segment. The first segment is loosely articulated with the sternum of the antennal segment, so as to be freely movable upon it ; it is very short upon the outside, but expands somewhat on the inner side, which terminates distally in a thin tubular process arising from the oral side of the segment and directed upward to a level with the dorsal side, so that, in the ordinary position of the appendages, its orifice is closed by contact with the first segment of the peduncle of the antennula. This tubular process readily admits a large bristle, which can be pushed through it round into the cavity of the segment itself. It undoubtedly contains the canal of the green gland. The second segment is small, closely united with the third, and bears upon its outer side a slender scale, which reaches nearly to the tip of the peduncle, is about five times as long as broad, and thickly ciliated along both edges. The third segment, as seen from below, is almost wholly internal to the second, and is armed on the distal part of the inner margin with a small spiniform tubercle. The fourth and fifth segments are subcylindrical, the fourth is slightly longer than the fifth, and both are ciliated each side. The flagellum is about as thick at base and nearly as long as the major flagellum of the antennula.

The buccal opening is nearly square. The branchiostergites extend forward quite over the sternum of the antennary somite, and their anterior extremities are applied to the basal segments of the antennæ, which, however, are freely movable upon the antennary somite. The epistome is short, not extending at all in front of the bases of the antennæ, is nearly on a level with the dorsal wall of the efferent passages from the branchial chambers and on a plane above the bases of the antennæ, so that the efferent passages terminate in the space between the upturned edges of the squamiform processes of the inner sides of the basal segments of the antennulæ and just beneath the short two-spined rostrum. In the middle of the slightly raised and regularly arcuate posterior edge of the epistome there is a slight elevation with a tuft of hairs. The anterior part of the endostome is on a plane somewhat above the plane of the epistome, but the space below is filled by the soft and fleshy labrum which projects considerably below the raised posterior edge of the epistome.

The mandibles (Pl. IV. fig. 2) are wholly without molar areas and with crowns expanded into very broad and thin lamellæ serrated along the cutting edges with about fourteen acutely triangular teeth, of which one at the anterior angle and one in the middle are much larger and more prominent than the others. The palpus (fig. 2^a) is short, but composed of three segments, of which the proximal is very small ; the second is fully as long as the terminal, and expanded distally, and the terminal about three and a half times as long as broad, and densely setose along the anterior edge and ventral side.

The lobes of the metastome (fig. 2) are very narrow and widely separated. The two lobes of the first maxilla (fig. 3) are very much as described and figured by Willemoes-Suhn in *Willemoesia leptodactyla*, the two lobes being very slender and strongly incurved, and the anterior the larger and with a slight elevation covered with a dense tuft of hairs on the outside near the base.

The second maxilla (fig. 4) has two small and slender protognathal lobes, of which the anterior is very much the larger. The scaphognath is very large, and with the posterior portion very broad and evenly rounded in outline posteriorly, while the anterior portion is much narrower, and reaches forward nearly to the base of the antenna. The endognath is apparently represented by a short and truncate lobe at the base of the anterior lobe of the protognath.

The first maxillipeds (Pl. IV. figs. 5, 5^a, 5^b) are greatly elongated and peculiarly modified. The exopodal lamella (*f*, fig. 5^a) is long and very broad, projects farther back into the branchial passage than the scaphognath, and terminates anteriorly in a small triangular lobe (*g*) ; while the exopod reaches forward considerably in front of the epistome, where its terminal lobes are somewhat upturned and help to enclose the efferent branchial passage. The proximal lobe of the protopod (*a*, figs. 5, 5^a) is triangular and densely setigerous along the edges, while the distal lobe (*a*′) is elongated, and bears the endopod and the peculiarly modified exopod, which lie together, and at nearly a right angle with the protopod. The endopod (*b*, figs. 5, 5^b) is slender, somewhat triquetral, reaches nearly to the bases of the terminal lobes of the exopod, is densely hairy along the edges, is divided near the middle by an imperfect articulation, and lies above and close along the inner edge of the exopod. The exopod (*c*, figs. 5, 5^b) is lamellar, very broad, concave dorsally, divided by several sutures, as shown in the figure, curved inward almost to the mesial line, and encloses the broad efferent passage ventrally and anteriorly. The terminal portion of the exopod is divided into two lobes (*d*, *e*, figs. 5, 5^b), which are stiff and more calcareous than the rest of the appendage. The outer and anterior of these lobes (*d*) is the larger, and is alone exposed as seen from below in the natural position of the appendages, while the inner (*e*) is somewhat triangular, with a narrow base of attachment, and is curved round above the other lobe, and serves to prolong the dorsal wall of the efferent passage, or, perhaps, as a valve for closing its orifice.

The second maxillipeds (fig. 6) are apparently wholly without exopodal or epipodal branches, and are so short that they reach but little beyond the ischia of the third pair. The ischium and merus are very short, together little more than half as long as the carpus, and both are setigerous along the inner edge, while the ischium has in addition a series of dentiform tubercles. The carpus is about two thirds of the whole length, nearly twice as long as broad, compressed vertically, and much broader in the middle than at either end, and setigerous, but not dentate or tuberculous along the inner edge. The propodus is less than half as long and less than half as wide as the carpus, while the dactylus is still smaller, tapered distally, and terminated in a slender curved and spiniform tip, and both propodus and dactylus are thickly armed with setæ and small spines.

The external maxillipeds (fig. 7) are long and slender, reach, when extended, nearly to the bases of the peduncles of the antennulæ, and are well clothed with hairs and setæ, but unarmed either with teeth or spines. There is a very small and rudimentary appendage (*a*), apparently representing the epipod, upon the outer side of the protopod. The ischium is a little longer than the merus and carpus combined, and a very little stouter than the merus. The merus is about two thirds as long as the ischium, while the three distal segments are subequal in length and together a little longer than the merus, the carpus and propodus tapering slightly distally, while the dactylus is slightly curved and tapers regularly to an acute tip.

The great chelipeds are smooth and naked throughout, except the prehensile edges of the digits of the chelæ, and differ somewhat in size in different individuals, varying in length from about two and a half to nearly three times the length of the carapax, but the differences are apparently entirely independent of sex. The coxa is very stout and broad, far stouter than any of the succeeding segments, and much broader than the coxæ of the other legs. The basis is completely anchylosed with the ischium, which is expanded distally but at the same time strongly compressed vertically, strongly curved upward so as to fit the side of the carapax when turned out at right angles to it, and reaches, in this position, a little above the edge of the carapax, or, when turned forward, to the base or beyond the middle of the antennal scales. The merus is two thirds to four fifths as long as the carapax, compressed like the merus, but considerably expanded proximally, contracted in the middle and distally to near the tip where it is again expanded and thickened at the articulation with the carpus; the posterior edge is armed with an acute spine at the distal extremity, and with either one or two similar ones on the proximal half, while the anterior edge, except near the base, is armed with a scattered series of minute spines. The carpus is more than half as long as the merus, compressed and very slender to near the distal end where it is expanded and thickened for the articulation of the chela and armed above with a single acute spine and below with one or two small teeth, and along the whole length of the dorsal edge there is a distinct but narrow sulcus. The chela (Pl. IV. fig. 8) is about as long as the merus, and the digits themselves considerably longer than the basal portion, which is about as broad as but much thicker than the proximal part of the merus, though still strongly compressed ; the dorsal edge is evenly rounded, and projects in a small tooth and an acute spine above the articulation of the dactylus ; the inferior edge projects slightly proximally and then retreats at the base of the propodal digit, and except near the proximal end is occupied with a shallow sulcus, the edges of which are armed with several minute spines directed distally. Both digits are compressed, very slender, and regularly tapered to acute and very strongly curved extremities ; the dorsal edge of the dactylus is flattened, but scarcely sulcated, and the inferior edge of the propodal digit is flattened and slightly sulcated near the base, but rounded distally ; the prehensile edges of both digits are armed throughout with a close-set series of very short and very stiff setæ.

The legs of the second pair are slender, densely ciliated along the edges, and reach to the tips of the peduncles of the antennæ. The basis is anchylosed with the rather short ischium. The merus is considerably longer than the ischiobasis and reaches to the edge of the carapax. The carpus is a little shorter than the merus. The basal part of the chela (fig. 9) is a very little longer than the carpus, and is flattened and somewhat expanded distally, where it is a third as broad as long ; the propodal digit is very slender, nearly as long as the basal portion of the chela, nearly straight to the slender, acute, and chitinous tip, which is strongly curved, and the prehensile edge is thin and armed as in the first pair. The dactylus is almost exactly of the same form as the propodal digit, and its prehensile edge is armed in the same way, but the cilia upon the outer edge are much longer than on the corrosponding part of the propodus.

The third and fourth pairs of legs are successively a very little shorter than the second, and have very nearly the same form. From the coxal to the meral segment they are very nearly as stout as in the second pair, but the three distal segments are much more slender. The basal part of the chela (fig. 10) is subcylindrical and only very slightly expanded and flattened distally, while the propodal digit and the dactylus are nearly equal in length, very slender and weak, straight throughout, without incurved or chitinous tips, and densely ciliated along the prehensile edges.

The fifth pair of legs (figs. 11 and 12) are considerably shorter and more slender than the fourth, and all the segments except the propodus and dactylus have very nearly the same relative proportions as in that pair. The basal portion of the propodus is alike in the two sexes, a little longer than the carpus, subcylindrical and slightly tapered distally. The digits differ in the sexes. In the male (fig. 11) the propodal digit is about as long as the proximal thickness of the propodus, or a little longer, slender, and tapers to a rounded tip, while the dactylus is nearly or fully twice as long, considerably stouter, straight, and nearly cylindrical. In the female (fig. 12) the propodal digit is scarcely as long as in the male, is more slender, and tapers to an acute and incurved tip, which is somewhat flattened and excavated on the anterior and inner side, leaving an edge on the posterior side ; the dactylus reaches very nearly to the tip of the propodal digit, and is like it in form, but a little more sharply incurved at tip.

The branchiæ resemble the branchiæ of the Astacidæ, being slender, very soft, and composed of slender filaments, which are not closely crowded together. There are no branchiæ connected with the first and second maxillipeds, but above the base of the third maxilliped and between the lamellar epipod of the first maxilliped and the coxa of the first leg there is a slight lamellar elevation bearing a few filaments which are apparently branchial and may represent a very rudimentary epipodal branchia. The legs of the first four pairs bear each a well-developed podobranchia and a small epipodal plate, lying just at the edge of the carapax but not projecting into the branchial chamber, and above the bases of each of these legs there are two arthrobranchiæ and one pleurobranchia. There is also a pleurobranchia above the base of the fifth leg, so that there are in all sixteen well-developed branchiæ, — four podobranchiæ, eight arthrobranchiæ, and four pleurobranchiæ each side, as indicated in the following formula : —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	0	0	1	1	1	1	1	0	(5)
Podobranchiæ,	0	0	?	1	1	1	1	0	4
Arthrobranchiæ,	0	0	0	2	2	2	2	0	8
Pleurobranchiæ,	0	0	0	0	1	1	1	1	4
									16+(5)

As seen from above, the sides of the abdomen are nearly straight, and form, with the telson, a regular acute triangle. The first five somites are carinated dorsally, and the carina projects forward from each somite in an acute tooth, but the carina and tooth are small and low on the first somite, increase rapidly to the fourth, while on the fifth they are scarcely as prominent as on the fourth, and on the sixth the carina is inconspicuous and there is no tooth, but the top of the carina is traversed by a narrow longitudinal sulcus. On the first somite there are, in addition, two slender spines each side projecting forward above the articulations with the carapax. The dorsal surface of the abdomen, either side of the median carina, is smooth and scarcely at all sculptured ; but along the lateral margin, where the pleura bend abruptly and nearly perpendicularly downward, there is a series of deep longitudinal sulci, except upon the narrow first somite, which is unsculptured, and upon the sixth, where the sulcus is replaced by a simple carina. Of the pleura themselves, the first is nearly obsolete, the second is broader than deep, projecting back over the third with a broadly rounded margin, and forward in a prominent but rounded angle, and has a central circular depressed area; the succeeding pleura decrease regularly in size posteriorly, scarcely overlap when the abdomen is extended, are convex in outline posteriorly but straight or slightly concave anteriorly, and the third, fourth, and fifth are ornamented with a median curved carina extending two thirds of the length, but not well marked upon the fifth.

The telson is pretty regularly triangular, about twice as long as broad, is convex and slightly grooved longitudinally above, and terminates in an acutely rounded tip unarmed with spines. The lamellæ of the uropods scarcely reach the tip of the telson: the outer is nearly as broad as long, regularly rounded in outline except for a short distance on the outer edge near the tip, where the margin is more or less conspicuously truncated, but varying considerably in different individuals, and stiffened by two slightly diverging ribs in addition to the thickening of the outer margin; the inner lamella is stiffened by a single median rib, is nearly twice as long as broad, the lateral margins are approximately straight and parallel, and the tip is regularly rounded in outline.

In the male the first pair of abdominal appendages (Pl. IV. fig. 14) are much longer than the protopods of the second pair, reach slightly beyond the bases of the fourth thoracic legs, and have an imperfect articulation at about a third of the way from the base to the tip; the basal portion is somewhat triquetral, while the terminal expands into a smooth, naked, and thin lanceolate lamella slightly concave posteriorly. The second pair reach slightly farther forward than the first, and the protopod and lamellæ are about equal in length. The lamellæ are narrow, lanceolate, and thickly ciliated along the edges; the inner is about as long as the outer, and bears the two styliform processes usually characteristic of males in the Macrura. These styliform processes are a little less than a third as long as the lamella itself, and arise together at about a third of the way from the base to the tip of the lamella; the inner, like that upon the three succeeding pairs of appendages, arises from the slightly thickened inner edge of the lamella, is ridged, of nearly equal width to the rounded tip, and nearly naked except a line of cilia along the posterior margin. The outer process arises just in front of the inner, and its base is at a right angle to that of the outer; it is more slender than the outer, tapers distally, and is ciliated on both edges and on the anterior surface. The three succeeding pairs of appendages are similar to the second pair, but the fourth and fifth pairs are successively a little shorter, and, as usual among Macrura, they all want the outer of the two styliform processes of the inner margin of the inner lamella.

In the female the first pair of abdominal appendages (Pl. IV. fig. 13) are about as long as in the male; the basal portion, or protopod, is scarcely more than half as long as the terminal lamella, is narrow, compressed, turned inward toward the mesial line, and clothed thickly along the outer and the distal part of the inner edge with long ovigerous hairs; the terminal lamella is multiarticulate, like the lamellæ of succeeding appendages, but a little narrower than they, and is clothed with numerous ovigerous hairs. The four succeeding pairs of appendages are very nearly like the three last pairs in the male, but the styliform process of the inner lamella is a little larger and more compressed.

The only specimen carrying eggs is the one above referred to as taken off the mouth of Chesapeake Bay. In this specimen the eggs are in an early stage of development, are nearly spherical and .65 to .70 mm. in diameter, and are carried in a mass behind the first pair of abdominal appendages, and between the appendages of the second and third pairs, the mass being principally supported by the first pair, very slightly by the third, and not at all by the fourth and fifth.

Five specimens give the following measurements in millimeters : —

Station	326	898	326	329	326
Sex	♀	♀	♀	♂	♂
Length from front of carapax to tip of telson	60.0	124.0	126.0	83.0	107.0
Length of carapax along median line	26.0	53.2	55.2	36.0	45.3
Breadth of carapax between spines of anterior margin	12.9	25.5	27.3	16.5	23.0
Greatest breadth (in front of cervical suture)	19.3	40.5	41.3	26.7	35.0
Length of first pair of legs * . .	67.0	140.0	161.0	100.0	125.0
“ merus	21.5	42.0	50.0	31.7	39.0
“ carpus	12.5	26.0	32.0	17.8	25.0
“ chela	21.0	46.0	49.0	30.0	38.5
“ dactylus . . .	12.6	27.0	29.0	18.0	22.0
“ second pair of legs . .	22.3	50.0	51.0	32.0	41.5
“ merus	6.1	13.3	13.2	8.5	11.0
“ carpus	4.0	9.3	9.4	5.2	6.6
“ propodus . . .	7.7	17.9	18.5	11.1	14.5
“ dactylus	3.9	8.5	8.8	5.2	7.0
“ fifth pair of legs . .	12.5	32.0	32.5	19.0	28.0
“ propodus	3.6	10.7	10.5	5.4	7.4
“ dactylus . . .	0.9	2.0	2.1	1.4	1.8
“ abdomen	34.0	70.0	71.0	47.0	62.0
Greatest breadth at second somite .	14.0	34.5	35.0	21.0	30.0
“ “ sixth somite .	7.5	17.3	18.0	11.1	15.0
Length of telson	11.0	23.0	23.0	14.8	20.0
Breadth of telson	5.7	12.2	12.2	7.9	10.5

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* In the second, third, and fourth columns the measurements of the first pair of legs are taken from the right leg; in the first and last columns, from the left. In the specimen of which the measurements are given in the fourth column, both legs of the first pair are present and the left one is a little shorter than the right and gives the following measurements : length, 158 mm. ; merus, 47 ; carpus, 31 ; chela, 48 ; dactylus, 28.

CRANGONIDÆ.

Ceraphilus Agassizii, sp. nov.

Plate VII. Figs. 4-5ª.

The carapax is short and broad, and in the female rounded and swollen above and somewhat convex longitudinally. The rostrum (*b*, in figs. 4ª and 5) is hidden from above by the anterior spine (*a*) of the dorsal carina, and is slender, spiniform, and scarcely if at all more prominent than the slender spine forming the outer angle of the orbit each side, and very much less prominent than the slender and acute antero-lateral angles (*d*), which are slightly divergent and reach a little by the bases of the antennal scales in the female, while they are much more divergent and much longer in the male, so that the distance between their tips is considerably greater than the greatest breadth of the middle portion of the carapax. A narrow dorsal carina extends the whole length of the carapax, and is armed with two laterally compressed and spiniform teeth directed forward, and of which the anterior is much the larger, projects immediately above the rostrum, and reaches considerably beyond its tip, while the posterior one is smaller and arises just in front of the cardiac region. There is occasionally a very minute additional tooth in the dorsal carina about midway between these two. On the gastric region either side of the dorsal carina there is a large spine directed forward ; below this is a stout hepatic spine from the upper side of which a prominent carinal ridge extends to near the posterior border, while from its lower edge a similar ridge extends downward and backward a short distance to the branchial region, where it meets a much less distinct carina extending from the antero-lateral angle nearly to the posterior border. There is also a well-marked carina extending backward from the orbital spine (*c*, figs. 4ª, 5, 5ª) along either side of the gastric region and following a distinct suture terminating anteriorly just outside the orbital spine. The lateral margin of the carapax is strongly incurved, and projects inward in a prominent rounded lobe below the base of the first thoracic leg. All the spines of the carapax are proportionally longer in the male than in the female.

The eyes are small and black, and scarcely reach beyond the tip of the rostrum.

The first segment of the peduncle of the antennula is more than twice as long as the second, and the lateral process from its base is very long, and reaches as far forward as the segment itself, which is armed with a tuberculiform prominence at the outer edge of the distal extremity and with a much smaller one on the inner edge ; the second segment is short and has the outer distal angle considerably produced ; the ultimate segment is much broader than long. The flagella are subequal in length and in the female about as long as the peduncle, but in the male about twice as long as the peduncle and the outer longer and very much stouter than the inner or than the outer flagellum of the female.

The antennal scale is about as long as the sixth segment of the abdomen and about twice and a half as long as broad, and the ultimate segment of the peduncle reaches very nearly to the tip of the scale.

The external maxillipeds are much more slender than in *C. boreas* and reach by the tips of the antennal scales about half the length of the ultimate segment, which is no broader than the penultimate but fully twice as long and about six times as long as broad ; the antepenultimate segment is longer than the ultimate.

The thoracic legs are nearly as in *C. boreas*, but are all rather more slender and less hairy. In the first pair the carpal spines are smaller and the chelæ are nearly naked and less swollen than in *C. boreas*. The second pair are nearly as long as the first : the carpus and merus are subequal in length, and each is a little longer than the ischium ; the chela is very slender, about half as long as the carpus, with the digits scarcely a third as long as the basal portion of the chela. The third pair are about as long as the second, the carpus a little longer than the merus, the propodus two thirds as long as the carpus, and the very slender dactylus but little less than half as long as the propodus. The fourth pair do not quite reach the tips of the third, and the fifth reach slightly by the carpi of the fourth.

The abdomen is broad, slightly depressed and rounded above anteriorly, and tapers rapidly to the sixth somite, which is only a little longer than the fifth. The five anterior somites are armed with a median dorsal carina which is conspicuous and flattened above on the fourth and fifth. The epimeron of the first somite is broadly expanded anteriorly and projects in an obtuse tooth below ; the second is broad and evenly rounded in front and behind, and has a slight tooth below, but the inferior edges of the remaining epimera are straight and unarmed. The sixth somite, excluding spines, is about a fourth longer than the fifth, is armed above with four prominent and approximately equidistant carinæ, and the posterior edge projects in a large tooth either side of the base of the telson and in an acute angle at the lateral margin. The carinæ and the teeth on the edges of the epimera are more prominent in the male than in the female.

The lamellæ of the uropods are much shorter than the telson : the outer are from a little more than twice to about three times as long as broad ; the inner are about as long as the outer, and three to four times as long as broad.

The telson is about once and two thirds as long as the sixth somite of the abdomen, flattened and broadly channelled above, tapers regularly to an acute point unarmed with spines but furnished with two pairs of plumose setæ arising from the under side, and the margins are ciliated beneath.

In the male there is a very long median spine on the sternum of each of the four anterior somites of the abdomen, but no similar spines in the female.

The surface of the carapax and abdomen is sparsely clothed with minute pubescence, which is very easily removed with the coating of soft mud with which all the specimens are covered.

The number and arrangement of the branchiæ is the same as in *C. boreas*, and as indicated by the following formula : —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	0	0	0	0	0	0	(2)
Podobranchiæ,	0	0	0	0	0	0	0	0	0
Arthrobranchiæ,	0	0	0	0	0	0	0	0	0
Pleurobranchiæ,	0	0	0	1	1	1	1	1	5
									5+(2)

Five specimens give the following measurements in millimeters: —

Station	317	332	326	326	329
Sex	♂	♂	♀	♀	♀
Length from tip of rostrum to tip of telson	42.0	49.0	51.0	70.0	72.0
Length of carapax including rostrum	11.2	12.5	14.7	19.1	19.5
Greatest breadth of carapax anteriorly	7.7	9.4	11.4	15.2	15.3
Breadth between tips of antero-lateral spines	10.3	11.8	11.0	14.0	14.8
Length of anterior dorsal spine	3.5	4.5	3.5	3.7	3.6
" antennal scale	5.6	6.0	6.4	8.1	8.2
" sixth somite of abdomen excluding spines	5.3	5.7	6.3	8.2	8.3
" telson	9.1	10.2	10.3	13.6	14.0

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
317	31° 57′ 0″	78° 18′ 35″	333	2♂
326	33° 42′ 15″	76° 0′ 50″	464	1♂, 2♀
329	34° 39′ 40″	75° 14′ 40″	603	1♀
332	35° 45′ 30″	74° 48′ 0″	263	1♂, 4♀

A young specimen was taken in the U. S. Fish Commission dredgings off Block Island, in 1880, Station 891, N. Lat. 39° 46′, W. Long. 71° 10′, 500 fath.

Pontophilus Norvegicus M. Sars.

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?? *Hippolyte costata* Leuckart, Wirbelloser Thiere mit Fauna norddeutsch. Meeres, p. 159, 1847.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
306	41° 32′ 50″	65° 55′ 0″	524	5
309	40° 11′ 40″	68° 22′ 0″	304	7

Pontophilus brevirostris Smith.

Proc. National Mus., Washington, III. p. 435, 1881.

Plate VII. Figs. 1-1^b.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
314	32° 24′ 0″	78° 44′ 0″	142	15
315	32° 18′ 20″	78° 43′ 0″	225	2
321	32° 43′ 25″	77° 20′ 30″	233	1
327	34° 0′ 30″	76° 10′ 30″	178	25
333	35° 45′ 25″	74° 50′ 30″	65	2
344	40° 1′ 0″	70° 58′ 0″	129	6
345	40° 10′ 15″	71° 4′ 30″	71	20

This species is very closely allied to *P. spinosus* and *P. Norvegicus*, but is readily distinguished from them by the very short rostrum, which is tridentate, with the median tooth scarcely broader and very little longer than the lateral, about reaching to the cornea of the inner side of the eye and not projecting beyond the line of the spiniform outer angles of the orbits. The proportions of the body are more like *spinosus* than *Norvegicus*, but the carination and armature of the carapax are more like *Norvegicus*, while the sculpture of the distal somites of the abdomen is more like *spinosus.*

The dorsal carina of the carapax is armed with three spines, and frequently a smaller fourth one in front of the others and just back of the base of the rostrum ; the subdorsal carina is armed with two spines, as in *Norvegicus*, and often with a rudiment of a third behind these ; the lateral carina does not extend back of the middle of the carapax, and is armed with a single spine, as in *Norvegicus.* There are no distinct carinæ on the first four somites of the abdomen, but the fifth somite is flattened above and has subdorsal carinæ slightly diverging posteriorly, and below these, each side, another carina, nearly parallel with the subdorsal ; and the sixth somite is flattened above and subdorsally carinated, as in *spinosus*, though the carinæ are not quite as conspicuous on either somite as in that species.

The eyes, antennulæ, and antennæ are very nearly as in *P. spinosus.* The external maxillipeds reach a little beyond the tips of the chelipeds, the penultimate segment reaches nearly to the tip of the antennal scale, and the ultimate segment is a little less than twice as long as the penultimate, while in *P. Norvegicus* it is about once and a half as long, and in *P. spinosus* much more than twice as long, as the penultimate segment. The thoracic legs differ scarcely at all from those of *P. spinosus.*

The lamellæ of the uropods are very nearly as in *P. spinosus.* The inner lamella reaches nearly or quite to the tip of the telson, is lanceolate, and six or seven times as long as broad ; the outer lamella is about a tenth shorter than the inner, and about four times as long as broad. The telson is once and a fourth to once and two fifths as long as the sixth somite of the abdomen, is very narrow, slightly acuminate, and has a very narrow and acutely triangular tip, armed with only two very long, slender, and plumose setæ, which arise near together from the under side.

It appears to be a much smaller species than either *Norvegicus* or *spinosus*, the largest males being scarcely 25 mm. in length and the largest females about 36 mm.

This species was taken in great abundance, in 51 to 155 fathoms, off Block Island, in 1880 and 1881, by the U. S. Fish Commission. The specimen figured is from the Fish Commission collection, Station 873, 100 fathoms.

Pontophilus gracilis, sp. nov.

Plate VII. Figs. 2 - 3ᵃ.

This species is very much more slender and has much larger eyes than any other species of the genus known to me. It is represented in the collection by a single specimen, which is possibly immature, but, judging from the structure of the appendages of the first and second somites of the abdomen, is a female.

The carapax is nearly twice as long, along the dorsal line, as broad, slightly carinated, and so thin that the branchiæ are readily seen through it. The rostrum is about two sevenths as long as the rest of the carapax along the dorsal line, very slender, and the lateral teeth scarcely a third of the way from the base to the tip. The dorsal carina is not distinct except where it rises into two acute teeth directed forward, one on the gastric region and one on the anterior part of the cardiac. There is a slight lateral carina in the middle portion of the carapax, terminating anteriorly in a spine like those in the dorsal carina. A little farther down upon the carapax and a little in front of the anterior spine of the dorsal carina there is a small hepatic spine, making in all six spines exclusive of those of the anterior margin. The orbit is very broad and its outer border extends far forward and terminates in a slender spine, while the similarly slender spine of the antero-lateral angle extends still farther forward nearly or quite to a line with the tip of the rostrum.

The eyes are very large and reach to about the tip of the rostrum ; the cornea is oblique, somewhat compressed vertically, and its greatest breadth considerably more than the breadth of the antennal scale. The peduncle of the antennula scarcely reaches the middle of the antennal scale, and the lateral process from the base of the first segment reaches to the distal extremity of the segment itself ; the outer flagellum is slender and reaches to the tip of the antennal scale ; the inner is about a third longer, but scarcely stouter, than the outer. The antennal scale is about three fourths as long as the carapax exclusive of the rostrum, about four times as long as broad, only very slightly narrowed distally, and the tip evenly rounded. The distal segment of the peduncle is a little more than half as long as the scale, and the flagellum is slender and about twice as long as the carapax exclusive of the rostrum.

The first and second maxillipeds are nearly as in *P. Norvegicus*. The external maxillipeds reach by the tips of the antennal scales by fully half the length of the distal segment, which is a little longer than the penultimate, but only a little more than two thirds as long as the antepenultimate, while the two distal segments together are about as long as the antennal scale.

The anterior thoracic legs are very slender, reach a little beyond the tips of the antennal scales, and the chela itself is smooth, naked, strongly compressed distally, a little shorter than the antennal scale, about as long as the diameter of the carapax, and, excluding the very prominent distal spine of the inner margin, about a fourth as wide as long. The second legs are very small, as in the other species of the genus, slender, and scarcely reach the middle of the meri of the anterior pair. The third are very slender, about twice as long as the carapax, reach by the tips of the antennal scales the full length of the propodi and dactyli, which taken together are very nearly as long as the carpi, the dactyli being very slender and acute and about half as long as the propodi. The fourth and fifth legs are about as long as the first pair, and sparsely clothed with long hairs except upon the dactyli, which are strongly compressed vertically, about two thirds as long, and toward the base as broad, as the propodi.

The abdomen to the tip of the telson is about three times as long as, and slightly narrower than, the carapax. The sixth somite is more than a fifth of the entire length, compressed laterally so that the breadth is less than a fourth while the height is fully two fifths of the length, and flattened or obscurely channelled longitudinally in the middle of its length above. The telson is about as long as the sixth somite, very slender, flattened but scarcely channelled above, and the narrow tip armed with four very slender spines of which the median are twice as long as the lateral. The inner lamella of the uropod is as long as the sixth somite, projects considerably by the tip of the telson, is lanceolate, and more than five times as long as broad. The outer lamella is considerally shorter and slightly broader than the inner.

The inner lamella of the appendage of the first abdominal somite (Pl. VII. fig. 2^{b}) is about as long as the protopod, linear, and the margins not ciliated; the outer lamella is narrow-ovate, considerably longer than the inner, and of the usual structure. The inner lamella of the appendage of the second somite (fig. 2^{c}) is a little shorter and much narrower than the outer, and has a single stylet two fifths as long as itself arising from the inner margin near the base.

Length from tip of rostrum to tip of telson	30.0 mm.
Length of carapax including rostrum	7.8
Length of rostrum	1.7
Greatest breadth of carapax	4.1
Length of antennal scale	4.5
Breadth of antennal scale	1 1
Greatest diameter of eye	1.4
Length of sixth somite of abdomen	4.9
Length of telson	5.0

Station 315, N. Lat. 32° 18′ 20″, W. Long. 78° 43′; 225 fathoms.

Since the above description was written a specimen of this species has been taken in 458 fathoms, by the U. S. Fish Commission, Station 1029, off Martha's Vineyard. This specimen, an adult male 28 mm. long, agrees perfectly with the female except in the usual sexual characters, and proves beyond question that the specimens are adult, though the female is probably not fully grown. The eyes in the male are fully as large as in the female. The inner flagellum of the antennula reaches nearly half its length by the antennal scale, while the outer is only a little shorter than the inner, but very stout, fusiform, with the diameter at the thickest point equalling nearly half the breadth of the antennal scale. The inner lamella in the first pair of abdominal appendages (Pl. VII. fig. 3) is only half as long and less than half as broad as the outer, and almost entirely naked. In the second pair (fig. 3^a) the inner lamella is nearly as long as the outer, but only about two thirds as broad, lanceolate in outline, furnished with plumose marginal setæ like the outer, and bears the two stylets characteristic of the male at about a fourth of the way from the base to the tip of the inner margin. The marginal or major stylet is like the single stylet of the female and of the succeeding appendages of the male, about two fifths as long as the lamella itself, very narrow, and almost entirely naked except the usual hooklike setæ near the tip, while the minor stylet is a little stouter than the other, but only about a fourth as long as the lamella, and naked except a few minute hairs near the tip.

Sabinea princeps, sp. nov.

Plate VIII. Figs. 1-1^b.

Carapax with seven carinæ as in the other species of the genus, but with an acute rostrum as long as the antennal scales or longer, and armed above with a spine either side near the base and below with a single spine. The dorsal carina is very high, sharp, slightly arched longitudinally, and armed, from a little back of the orbit to the posterior margin, with seven or eight somewhat irregular teeth directed forward. The rostrum varies very much in length, in the male being often only a little shorter than the length of the carapax from the orbit to the middle of the posterior margin, but in large females often only half as long ; dorsally it is flattened and the margins slightly carinated, but beneath the edge is angular ; the basal portion is nearly horizontal, but the terminal portion is upturned and acute ; below the margin is armed with a slender spiniform tooth directed forward from the point where the terminal portion is upturned, and above with a similar tooth arising from the dorsal margin over either eye and directed outward and upward. The three carinæ each side of the carapax have about the same position as in the other species of the genus. The subdorsal is continuous almost to the orbit, and is armed with six or seven spiniform teeth directed forward. The next carina below is broadly interrupted on the anterior region, but back of this is armed with five or six teeth like those of the subdorsal carina, and in front, at the outer margin of the orbit, with a prominent slender and acute spine. The lower lateral carina is very prominent anteriorly and is armed with nine to twelve spiniform teeth, of which the three or four most anterior increase in size very rapidly, the anterior one forming a great and somewhat laterally expanded spine nearly or quite half as long as the rostrum, and reaching nearly to, or in the male often considerably beyond, the middle of the antennal scale.

The eyes are black, very large, pyriform, and including the peduncles much longer than the greatest diameter, which is about two thirds the breadth of the antennal scale.

The peduncle of the antennula reaches to about the middle of the antennal scale ; the flagella are subequal in length, in the female a little longer than the antennal scale, but in the male much longer and the outer very much stouter than in the female, and considerably thickened vertically.

The antennal scale is about a third as long as the carapax including the rostrum, and is itself of nearly the same form as in the allied species, but there is a prominent and acute spine near its base upon the outer edge of the second segment. The distal segment of the peduncle is very long, reaching nearly to the tip of the antennal scale, and the flagellum in the male is about as long as the abdomen, but considerably shorter in the female.

The external maxillipeds are slender, reach considerably beyond the tips of the antennal scales, and the proportions of the segments and of the exopods are almost exactly the same as in the other species of the genus.

The anterior legs reach to the tips of the antennal scales : the outer distal margin of the merus is prolonged into a slender spine, and there is a similar one upon each of the two outer distal angles of the carpus ; the chela is about as long as the merus, very stout, somewhat swollen, and nearly cylindrical at base, but compressed and expanded on the inner side distally, the prehensile edge nearly transverse, slightly arcuate, and armed with a very large spiniform tooth at the inner margin. The rudimentary second legs are small, very slender, and reach to the distal end of the ischia of the first : the ischium and merus are subequal in length and each much longer than the three distal segments, of which the carpus and propodus are subequal, while the dactylus is very small, only a little longer than the diameter of the propodus. The third legs reach slightly beyond the first, and the dactylus is very slender and acute, but only about one sixth as long as the propodus. The fourth and fifth are nearly equal in length, and the fourth reach to the tips of the third : the dactyli are about half as long as the propodi, very slender, with the upper surfaces densely ciliated.

The carinæ of the abdomen have the same arrangement as in *S. Sarsii*, but are much more conspicuous, and each of the epimera of the first two somites projects below into an acuminate spine, while the epimera of the third, fourth, and fifth somites are each armed with two similar spines. The dorsal carina upon the posterior half of the second somite is double, or rather V-shaped with the apex directed forward. The dorsal carina upon the third and fourth somites is very conspicuous, and upon each is prolonged in a tooth at the posterior margin, the tooth upon the fourth being prominent and horizontal and occasionally having a secondary tooth above its base. The two dorsal carinæ of the fifth somite are high and sharp, and each armed with a sharp tooth near the middle and with a similar one projecting over the posterior margin. The sixth somite is about once and a half as long as the fifth, its dorsal carinæ are very high and sharp and each armed with five to seven acute teeth of which the posterior project over the margin as in the fifth somite; the posterior margin is in addition armed with two spines each side, one at the inferior angle and another above the base of the telson.

The outer lamella of the uropod is a little longer than the sixth somite, about twice and a half as long as broad, and obtusely rounded at the tip; the inner is longer than the outer, ovate-lanceolate, and not quite a third as broad as long.

The telson is about once and a half as long as the sixth somite, tapers regularly throughout, and is ornamented above with two carinæ converging to the tip, which is acute, unarmed, and naked.

All the exposed surfaces of the carapax and abdomen except the spines and carinæ, and a considerable part of the surface of the appendages, are clothed with a very short and dense pubescence, which readily brushes off with the soft mud with which most of the specimens are covered.

Six specimens give the following measurements in millimeters: —

Station	326	326	337	326	326	312
Sex		♂	♂	♂	♀	♀
Length from tip of rostrum to tip of telson . .	56.0	65.0	89.0	98.0	77.0	125.0
Length of carapax including rostrum . . .	21.0	23.2	33.5	35.0	28.5	49.5
Length of rostrum . .	9.2	9.6	15.5	13.5	12.0	21.0
Length of antennal scale . .	7.0	8.1	11.5	12.5	9.2	15.0

The eggs are very large, being, even in alcoholic specimens, about 2.5 and 3.0 mm. in least and greatest diameter, while in *S. septemcarinata* they are about 1.0 by 1.4 mm. in alcoholic specimens.

The number and arrangement of the branchiæ are the same as in *S. septemcarinata*, and may be indicated by the following formula: —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	0	0	0	0	0	0	(2)
Podobranchiæ,	0	0	0	0	0	0	0	0	0
Arthrobranchiæ,	0	0	2	0	0	0	0	0	2
Pleurobranchiæ,	0	0	0	1	1	1	1	1	5
									7+(-)

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
312	39° 50′ 45″	70° 11′ 0″	466	1 ♀
326	33° 42′ 15″	76° 0′ 50″	464	10 ♂, 9 ♀, 3 young.
337	38° 20′ 8″	73° 23′ 20″	740	1 ♂

Also obtained in the U. S. Fish Commission dredgings off Block Island in 1880, Station 892, N. Lat. 39° 46′, W. Long. 71° 5′, 487 fathoms; and Station 893, N. Lat. 39° 52′ 20″, W. Long. 70° 58′, 372 fathoms.

The long and spined rostrum and the long spines and teeth of the carapax and abdomen give this gigantic species a very different aspect from the other species of the genus; but the oral appendages, the number and arrangement of the branchiæ, and other structural details, agree perfectly with *S. septemcarinata*, the type species of the genus. The present species is, however, much more closely allied to *S. Sarsii* Smith (Trans. Conn. Acad., V. p. 59, Pl. II. figs. 6–8, 1879) than to *septemcarinata;* the elongated and acute rostrum, the prominent dentation of the carapax and abdomen, and the structure of the telson in *Sarsii* show a marked approach toward the *princeps*, although the two species are very different in general appearance.

Sabinea hystrix (*Paracrangon hystrix* A. Milne-Edwards, Ann. Sci. Nat., 6^{me} série, XI. No. 4, p. 6, 1881), from 730 fath., near Guadaloupe, is very closely allied and probably identical with this species, which, though externally somewhat like *Paracrangon echinatus* Dana, differs essentially in several structural features in which, as pointed out above, it agrees with the typical species of *Sabinea.* In *Paracrangon echinatus*, not only are the second pair of legs completely obsolete, but there are no arthrobranchiæ, the branchial formula being the same as for *Ceraphilus boreas* and *Agassizii.*

RHACHOCARINÆ, subfam. nov.

Anterior thoracic legs stout, non-chelate; second pair slender, chelate, and with multiarticulate carpi; coxæ of the external maxillipeds articulated with the adjacent edge of the carapax.

These characters sufficiently distinguish this subfamily from all other Crangonidæ. The broad, ovate antennal scales with both margins ciliated are probably also characteristic of the subfamily, which, as far as known to me, contains but one genus.

RHACHOCARIS,* gen. nov.

Plates V. and VI.

The carapax is subcylindrical, carinated longitudinally, rostrated, with prominent antero-lateral and antennal spines, and the margins of the branchiostegites are strongly incurved opposite the bases of the second pair of legs and are connected each side with the coxæ of the external maxillipeds by two processes from the coxa interlocking between their converging tips a projection in the margin of the carapax so as to form therewith an articulation admitting slight motion.

The eyes are large and pyriform, with the cornea expanded and very large. The antennulæ are very nearly as in *Crangon.* The antennal scale is broad,

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* Ῥάχις and καρίς.

ovate, the entire margin ciliated, and with the tooth of the outer margin small and far back from the tip. The other parts of the antenna are nearly as in *Crangon.* The oral appendages are very similar to those of *Crangon* and the closely allied genera, and the labrum, metastoma, mandibles, maxillæ, and second pair of maxillipeds are very nearly as in *Crangon vulgaris.* In the first maxilliped the proximal lobe of the endopod projects inward much more prominently and the distal lobe is longer than in *Crangon.* There are two arthrobranchiæ at the base of the external maxilliped, as in *Sabinea,* and the stout endopod is composed of three segments as in Crangoninæ, but the two distal segments are very short and the terminal one acute and spined.

The legs of the first pair are symmetrical and about as large as the external maxillipeds; the propodus is short and tapers distally, and the dactylus is small, slender, and capable of flexion against the inner side of the propodus. The legs of the second pair are elongated, slender throughout, and, in all the specimens examined, slightly unsymmetrical in length; the carpi are long and muiltarticulate; and the chelæ small. The last three pairs of legs are slender and nearly alike.

The number and arrangement of the branchiæ differ from all the Crangonidæ known to me. In *R. sculpta,* the second species here described, there are epipods on the bases of the first and second maxillipeds and two arthrobranchiæ at the base of each external maxilliped, one arthrobranchia for each of the thoracic legs except the last pair, and a pleurobranchia for each side of the last five thoracic somites, — making two epipods, six arthrobranchiæ, and five pleurobranchiæ each side, as indicated in the following formula: —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	0	0	0	0	0	0	(2)
Podobranchiæ,	0	0	0	0	0	0	0	0	0
Arthrobranchiæ,	0	0	2	1	1	1	1	0	6
Pleurobranchiæ,	0	0	0	1	1	1	1	1	5
									11+(2)

The abdomen is sculptured and spined to correspond with the carapax, and the exoskeleton is throughout very thick and massive.

In the three species here described, the hinges at the last three articulations of the abdominal somites — that is, at the articulation of the fifth with the fourth, the sixth with the fifth, and of the telson with the sixth — present a peculiar modification by which the hinge is very much strengthened and is at the same time apparently made capable of being clamped or locked so as to hold the terminal somites firmly extended. In addition to the ordinary hinge, at each of these articulations, there is a process arising from the anterior somite just below the hinge and curved backward and upward concentrically with the hinge, and this process fits accurately and is slightly overlapped along its edges by a similarly curved groove in the posterior somite. When the abdomen is completely flexed the ends of these curved processes project dorsally considerably beyond the grooves, but when the abdomen is fully extended the processes are withdrawn so as to expose the dorsal part of the groove, and in this position in the contracted alcoholic specimens the somites are firmly clamped, apparently by the pressure of the ends of the processes upon the concave posterior walls of the grooves, and held rigidly extended, so that it is very difficult to flex the somites, unless the tip of the abdomen is pulled backward with considerable force, when the processes slide easily through the grooves and the somites are readily flexed. It is probable that in life, while the extensor muscles of the abdomen are relaxed, the processes move easily through the grooves; but when the extensor muscles are strongly contracted the hinges are clamped as in the alcoholic specimens, so that the animal can voluntarily hold the telson and the spiny terminal somites of the abdomen rigidly extended as a means of self-defence.

In all three of the species, when the abdomen is fully flexed, the tip of the telson is brought directly below and very near to the mouth.

A. Milne-Edwards, in the paper already referred to, which has been published since the part of this report relating to the Crangonidæ was ready for the printer, has described three new species belonging to a new genus, *Glyphocrangon*, which is apparently very closely allied to the genus here described and possibly identical with it. In Milne-Edwards's genus the telson is described as consolidated with the sixth somite of the abdomen.* It is scarcely to be supposed that Milne-Edwards could mistake the peculiar articulation of the telson with the sixth somite of the abdomen, which is described above and which is equally characteristic of the articulation of the sixth somite with the fifth and of the fifth with the fourth, for actual consolidation, or overlook the remarkable character of the articulation of the external maxillipeds with the carapax; and as neither of the species here described and figured agrees fully with the description of either of the species of *Glyphocrangon* in the spines of the carapax and abdomen, I am forced to the conclusion that Milne-Edwards's genus is different from mine, though possessed of quite as remarkable characters.

Rhachocaris Agassizii, sp. nov.

Plate V. Fig. 2. Plate VI. Fig. 2.

Female. — The carapax has eight conspicuous longitudinal carinæ which are interrupted by a very deep cervical and a broad and deep gastro-orbital sulcus, but, aside from the carinæ, sulci, and spines, is nearly cylindrical. The rostrum is about two thirds as long as the rest of the carapax along the dorsal line, flattened above, triangular but with the edge flattened and distally slightly grooved below, and tapers regularly to an acute and gently upturned tip ; above there is a narrow but distinct median carina extending the whole length, and the margins are carinated and each armed just above the front of the eye with a prominent and acute spine directed forward and upward ; below the rostrum is unarmed. Just back of the base of the rostrum there is a pair of spines like those upon the rostrum, but slightly larger and with the bases elongated and laterally compressed. From these teeth two parallel dorsal carinæ extend to the posterior margin, but each one is broken into ten or eleven elongated teeth turned slightly forward, truncated above, and all except the first and last with flattened and conspicuously punctate tops. The space between these carinæ is concave with a deep transverse depression at the cervical suture, but smooth except a few small tubercles along the carinæ and one on the median line in front. The frontal margin is transverse and nearly straight, but the lateral angle is armed with three very large and acute spines : a very slender antennal spine directed upward and forward from just above the base of the antenna ; directly below this a somewhat larger one (the lateral angle itself) slightly compressed laterally and curved downward and then directed forward below the antennal scale ; and, arising outside and a little back of these, a very broad, dentiform, vertically compressed spine directed outward and forward, terminating in an acute tip as far forward as the tip of the antennal spine, and apparently representing the anterior part of the lower of the three lateral carinæ, but separated from it by the broad and very deep depression of the cervical suture. The broad triangular space between this carinal tooth and the gastric region is depressed and smooth. The posterior part of the middle lateral carina is prominent and terminates at the cervical suture in a long tooth directed forward ; posteriorly it extends to the posterior margin and has the edge thick, flattened and punctate. The upper of the lateral carinæ is not evident in front of the cervical suture, is less conspicuous than the dorsal, and is obscurely divided into about four truncated teeth flattened and punctate above. On the gastric region in front of this carina there is an irregular group of elongated tubercles extending to the gastro-orbital suture, but with this exception the sides of the gastric region are unarmed, as are the remaining spaces between the carinæ of the dorsal part of the carapax, except a few very small tubercles either side of the cardiac region, and a few still smaller ones below the upper lateral carina and near the posterior margin. The lower of the lateral carinæ is broad, punctate along its edge, and extends from near the base of the spine of the antero-lateral angle almost to the posterior margin, with a broad and deep interruption at the cervical suture. On the branchial region below this carina there are about three irregular elongated and punctate ridges, and near the posterior margin there are a few small tubercles, but with these exceptions the branchial regions are unarmed. There is, however, a narrow but well-marked carina the whole length of the lateral margin.

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* In characterizing the genus he says, "Le septième article abdominal est presque entièrement soudé au sixième"; and in the description of *G. spinicauda*, the first species, "Le septième article est immobile sur le précédent, il est triangulaire, bicarené en dessus, très pointu, et au lieu d'avoir la même direction que les autres articles, il se relève et son extrémité est dirigée en haut."

The eyestalks are slender and very small in proportion to the eyes themselves, which are approximately spherical, slightly compressed vertically, and with the horizontal diameter about three fourths as great as the breadth of the antennal scale and only a little less than the length of the eye to the base of the stalk. In the alcoholic specimen, the pigment is deep purplish and is probably not black in life.

The peduncle of the antennula reaches to the tip of the antennal scale and nearly to the tip of the rostrum, and is clothed along the sides and below with very fine hairs, but is nearly naked above; the first segment is a little longer than the second and third together, the second nearly as long as the last, which is less than twice as long as broad. The flagella are both nearly naked: the outer is about as long as the peduncle, the proximal two thirds of its length vertically compressed and broad, but the terminal portion suddenly contracted; the inner is a little longer than the outer, very slender and regularly tapered.

The antennal scale is regularly ovate, with the greatest breadth about two thirds of the way from the tip to the base, where it is very much contracted at the articulation; both margins are thickly ciliated, and the tooth of the outer margin is represented by an obscure angular projection at less than a third of the way from the base to the tip. The narrowness of the articulation permits great lateral motion in the scale, so that it may be turned outward at nearly a right angle to the body. The segments of the peduncle are without spines or tubercles; the last segment is about as long as the breadth of the scale and reaches three fourths of the way from its base to its tip, and the inner edge is compressed and ciliated. The flagellum is a little longer than the carapax including the rostrum, slender, compressed vertically, and almost naked.

The tips of the external maxillipeds reach to about the tips of the antennal scales. The proximal of the three segments of the endopod is about as long as the antennal scale and five or six times as long as broad; the second segment is about two fifths as long as, and slightly broader than, the first, vertically compressed, thickly ciliated along the inner edge, and armed beneath with a single movably articulated spine near the distal end, and with two or three similar spines along each edge; the last segment is a little longer than the second, flat and smooth above, tapers from the base to a slender curved and acute tip, and the under surface and lateral margins are armed with thirteen or fourteen movably articulated spines among which there are a few fascicles of setæ. The exopod is very slender, the basal portion slightly longer than the flagelliform portion, and the whole considerably shorter than the proximal segment of the endopod.

The legs of the first pair are just about as long as and scarcely stouter than the external maxillipeds, and reach a little beyond the bases of their dactyli, or nearly to the tips of the peduncles of the antennæ: the ischium is about as long as the propodus, the inner and outer margins nearly parallel, the outer articulating with the merus, while the inner is thin, nearly straight, closely approximated, and armed with a few setæ, and each projects forward beyond the articulation with the merus in a narrow dentiform prominence; the merus is as long as the three distal segments together, about a fourth as long as broad, slightly compressed vertically and with a few setæ along the inner edge, but otherwise unarmed; the carpus is short, about as broad as long, and unarmed, and is so articulated with the merus as to be capable of flexion backward and beneath it; the propodus is slightly more than half as long as the merus, rounded, slightly swollen, tapers to a very narrow distal extremity, and is smooth and unarmed except upon the upper and inner side where it is furnished with three longitudinal series of fascicles of soft setæ; the dactylus is about half as long as the propodus, very slender, curved and acute, smooth and naked, and capable of nearly complete flexion on the setigerous side of the propodus. The manner in which the distal segments of these limbs are articulated brings the setigerous sides of the propodi and the points of the dactyli in direct opposition to the spinous sides of the two distal segments of each of the external maxillipeds, and these two pairs of appendages are probably used together as prehensile organs.

The legs of the second pair are unarmed and naked, very slender, the distal portion but little stouter than the proximal part of the flagellum of the antenna, and a little unsymmetrical, the left being slightly stouter than the right and reaching nearly to the tip of the rostrum, while the right reaches a little beyond: the coxa is short and nearly cylindrical; the ischium is a little longer than the propodus in the first pair, much broader than the coxa, very much compressed vertically and the inner edge slightly expanded proximally, so that the breadth is about a fourth of the length; the merus is about a fourth longer than the ischium, the right a little longer than the left, little more than half as broad as the ischium, nearly uniform in breadth, and compressed vertically but much less so than the ischium; the carpus is more than twice as long as the merus and more slender, strongly compressed, very slightly tapering at the distal end, composed of thirty-one segments on the right side and twenty-three on the left, and the most distal segment in each about as long as the three next taken together; the left chela is slightly larger than the right, but neither is larger than the distal segment of the carpus, the digits are both short, the prehensile edge of the propodal one considerably oblique and shorter than the dactylus, which is itself scarcely longer than the breadth of the propodus.

The legs of the third pair are nearly naked, slender, and reach to the tip of the rostrum: the merus is about twice as long as the ischium, and these two segments taken together are longer than the three distal segments and are of nearly uniform diameter throughout and very slightly compressed; the carpus is a little shorter and more slender than the ischium; the propodus is nearly twice as long as the carpus, cylindrical, and slightly tapered distally; the dactylus is narrower than the distal end of the propodus, nearly a fourth as long as the propodus, nearly straight, a little compressed vertically, and tapered from the base to the tip. The fourth and fifth pairs of legs are alike and very similar to the third pair, but are slightly stouter throughout, the propodus is furnished with a dense fascicle of setæ outside the base of the dactylus, and the dactylus itself is considerably longer than in the third pair, strongly compressed vertically, concave above and convex below, and lanceolate, being broader in the middle than the distal end of the propodus, but narrowed toward the base and tapered to an acute tip.

The sternum is flat, triangular, and wholly unarmed.

The abdomen is about once and a half as long as the carapax including the rostrum, is narrower than the carapax, and as seen from above tapers regularly from the base to the tip of the telson. There is a sharp medio-dorsal carina from the base to the telson, but interrupted on all the somites but the first ; a single lateral carina each side is indistinctly indicated on the first two or three somites ; and the dorsal surface generally is studded with prominent tubercles, many of which are elongated and all the larger ones with flattened and punctate tops. Upon the first somite, the median carina is thin and very high and projects forward in an acute tooth ; either side, in line with the upper lateral carina of the carapax, there is a very prominent acute and spiniform tooth directed obliquely forward. On the second and third somites, the dorsal carina is divided into two nearly equal parts by a smooth and very conspicuous sulcus, which passes slightly backward either side across the whole dorsum of the segment and down parallel with and near to the posterior margin of the epimeron ; the anterior part of the carina on the second somite is nearly as high as on the first and projects slightly forward, but the posterior part on the second and both parts on the third are much lower and do not project in front or behind. On the fourth somite, the carina is divided into two unequal parts by a less conspicuous sulcus, the anterior part being like that upon the third somite, while the posterior part is twice as long, thickened and flat above anteriorly, but posteriorly higher, more acute, and projecting slightly over the fifth somite. On the fifth somite the carina is unequally divided by a similar sulcus, but the anterior portion is more prominent than on the fourth, and the posterior part is very prominent, its anterior half being formed of two longitudinally elongated tubercles slightly diverging posteriorly, and between and back of them a single very high sharp and triangular tooth. The carina upon the sixth somite is broken anteriorly by a small notch, and posteriorly rises in an acute edge and projects far back over the base of the telson in an acute tooth. The epimeron of the first somite is narrow, does not project below the margin of the carapax, is rounded below and almost wholly covered by the anterior expansion of the epimeron of the second somite when the abdomen is fully flexed. The epimeron of the second somite projects much below the epimeron of the first, the anterior margin is nearly as convex in outline as the posterior, the inferior margin projects in the middle in a very long, slender, and outcurved spine, in a much smaller spine at the posterior angle, and in a small tooth anteriorly ; on the outer surface a sulcus, like and nearly parallel with the sulcus of the porterior border, passes from near the anterior hinge to the base of the large spine of the inferior margin, but between and outside of the sulci the surface is sparsely tuberculous. The epimera of the third, fourth, and fifth somites have a smooth depressed area along the anterior margin, and are each armed below with two slender acute and out-curved spines, of which the anterior one on each epimeron is about as long as the large spine of the second epimeron, while the posterior spines increase in length from the second to the fifth somite, that upon the fifth epimeron being longer than the anterior spine of the same epimeron and directed backward as well as outward ; the middle portion of the outer surface of each of these epimera is raised and sparsely tuberculous, and there is also a line of small tubercles between the sulcus and the posterior margin on the third, but on the following epimera the transverse sulcus of the dorsum does not extend down the epimera. Most of the tubercles on the side of the sixth somite are arranged in two longitudinal lines, an irregular but prominent one between the two hinges and a less prominent one below. The lateral angles of the sixth somite project downward, outward, and backward in a very large and acute spine outside the base of the uropod.

The telson is a little longer than the rostrum, slightly expanded toward the base, but the distal two-thirds is narrow, and terminates in a slender spiniform and slightly upturned tip unarmed with spines or setæ. On the dorsal side there is a sharp median tooth beneath the projecting carinal tooth of the sixth somite ; either side there is a sharp carina extending from the base nearly to the tip, leaving, except at the base, a smooth and deep groove between them ; the lateral edges are strongly carinate, leaving a smooth groove either side, and a wide and shallow groove the full width of the under surface.

The lamellæ of the uropods are about three fourths as long as the telson : the inner lamella is obtusely lanceolate and nearly four times as long as broad ; the outer is much broader, the tip ovately rounded, and the very prominent lateral tooth about a fourth of the way from the tip to the base.

The inner lamella of the appendage of the first abdominal somite is very short, about a third as long as the outer, obtuse, and about half as broad as long.

The sterna of all the abdominal somites are unarmed.

The eggs are very large, being, in alcohol, about 2.6 and 3 mm. in least and greatest diameter, and are proportionally few in number, there being not far from one hundred carried by the specimen examined.

The single specimen seen, a female, gives the following measurements : —

Length from tip of rostrum to tip of telson	111.0mm.
Length of carapax, including rostrun	46.0
Length of rostrum	18.0
Breadth of carapax in front, including spines	30.0
“ “ at cervical suture	17.0
“ “ at middle, including spines	21.0
Diameter of eye	5.0
Length of antennal scale	13.1
Breadth of antennal scale	7.1
Length of external maxillipeds	27.4
“ first pair of legs	27.2
“ carpus	2.3
“ propodus	6.2
“ dactylus	3.4
“ second pair of legs	right, 42.0 mm. ; left, 39.0

Length of	merus	right, 8.4 mm.;	left, 8.7 mm.
"	carpus	" 19.9	" 17.5
"	chela	" 1.2	" 1.1
"	third pair of legs		41.0
"	fifth pair of legs		46.0
"	telson		20.0

Station 326, N. Lat. 33° 42′ 15″, W. Long. 76° 0′ 50″, 464 fathoms.

Rhachocaris sculpta, sp. nov.

Plate V. Fig. 3. Plate VI. Figs. 3-3^1.

Female. — This species, though closely resembling the last in structure and general appearance, differs very conspicuously in the ornamentation of the carapax and abdomen, and in the form of the dactyli of the fourth and fifth pairs of thoracic legs. It is distinguished from *R. Agassizii* at a glance by having the dorsal and upper lateral carinæ of the carapax only obscurely indicated by lines of acute tubercles and the spaces between the carinæ tuberculous, by having two short spines each side in place of the great lateral spine of the antennal region and a small bidentate tooth in place of the sharp branchial spine of *R. Agassizii*, and in having three instead of two lateral spines on the epimeron of the fifth somite of the abdomen.

The postero-lateral angle of the carapax is more prominent and angular than in *R. Agassizii*, but in other respects the form is very nearly the same. The lateral carinæ on the posterior part of the rostrum are not so high, and the two teeth at the base of the rostrum are even smaller than the rostral teeth and are nearly erect. All the carinæ of the carapax are much less prominent, so that the carapax is more regularly rounded. The space between the two dorsal carinæ is scarcely at all depressed, the transverse sulcus at the cervical suture is not as deep, and there are two lines of small spiniform tubercles extending the whole length of the space, and the dorsal carinæ themselves are represented by two similar lines of larger spiniform tubercles with about twelve tubercles in each line, and with an obscure line of minute tubercles just outside of them. Below the dorsal carina and just back of the eye either side, at the extreme anterior end of the lateral lobe of the gastric region, there is a very large vertically compressed and acute tooth or spine connected with the lateral carina of the rostrum by a low but conspicuous ridge, just back of the base of this tooth there are one or two small spines, and on the rest of the triangular lateral lobe of the gastric region between these and the cervical suture there are approximately twelve spines or tubercles, of which those in the middle of the lobe are larger than the others. Of the three spines of the antennal region, the antennal itself is longer than in *R. Agassizii*, much stouter, considerably expanded at the base and directed strongly outward as well as forward and upward; the spine of the antero-lateral margin is stouter and directed more outward; while back of and between these spines there are two relatively small acute teeth directed forward, one behind the other, and of which the anterior is considerably the larger, and in the space between these teeth and the gastric region there are two or three irregular lines of minute acute tubercles. Back of the cervical suture, the upper lateral carina is high, conspicuous, and marked by a line of about six acute teeth directed slightly forward, and the depression between these and the lateral carina is armed with minute spiniform tubercles obscurely arranged in longitudinal lines. The middle lateral carina is distinct, armed in front with a small bidentate tooth and back of this by a very few small and irregular teeth. The lower lateral carina is distinct, with the edge slightly crenulated but not dentate. Below the carina of the antennal region there is a longitudinal rugose ridge, and below and back of this a similar ridge on the lower part of the branchial region. The surface of the branchial region between the carinæ is roughened by many minute tubercles, the inferior margin is bordered by a conspicuous carina as in the last species, and just above this at the postero-lateral angle there is a conspicuous elongated tubercle.

The eyes are a little larger than in the last species, but do not differ in other respects. The peduncles of the antennulæ are clothed with coarser hairs than in the last species, and the distal segments are hairy above as well as on the sides,.but in other respects they do not differ. The antennal scale is a little broader than in the last species and the tooth of the outer margin is more prominent and nearly half-way from the base to the tip, but the peduncle and flagellum do not differ. The distal segment of the external maxilliped is no longer than the penultimate, and the spines upon these two segments are a little more slender and the whole appendage a little shorter than in *R. Agassizii.* The legs of the first pair are a little shorter as a whole, and the propodi and dactyli are relatively shorter. The legs of the second pair are exactly as in *R. Agassizii* except that they are shorter and have fewer segments in the carpi, the right leg scarcely reaching the tip of the peduncle of the antenna, the left a little shorter, while the right carpus has twenty-three segments and the left twenty. The legs of the third pair are stouter than in *R. Agassizii* and only reach to tips of the antennal scales, but the relative lengths of the segments are about the same. The fourth and fifth pairs are proportionally short and stout, and the dactyli very different from those of *R. Agassizii.* These are alike in both pairs, about a fifth as long as the propodi, shorter than in the third pair, not at all compressed but nearly cylindrical, even slightly swollen distally, and very abruptly contracted into a bifid tip, the inner tooth of which is the longer, more acute, and curved.

The form and sculpture of the abdomen is very similar to that of the last species, but the dorsal carina on the first somite is interrupted posteriorly and on the second is not so high ; the teeth of the lateral carinæ on the first somite are not quite as acute ; the tubercles over the surface generally are more irregularly arranged, and none of them are much elongated ; the marginal spines of the epimera are shorter and less curved, but the anterior tooth on the second epimeron is much larger though obtuse ; the fifth is armed with three spiniform teeth, a median tooth, and two smaller nearly equal lateral teeth ; and the lateral spine of the sixth somite is smaller and not directed so much backward. There are no differences of importance in the form of the telson, uropods, or other abdominal appendages.

The eggs are slightly larger than in *R. Agassizii*, and of about the same number.

The specimen above described gives the following measurements: —

Length from tip of rostrum to tip of telson	108.0 mm.
Length of carapax, including rostrum	44.0
Length of rostrum	18.5
Breadth of carapax in front, including spines	19.3
“ “ at cervical suture	15.4
“ “ at middle, including spines	21.5
Length of antennal scale	12.7
Breadth of antennal scale	6.8
Diameter of eye	5.5
Length of external maxillipeds	22.5
“ first pair of legs	22.2
“ second pair of legs	right, 29.0 ; left, 27.5
“ merus	“ 6.2 “ 6.2
“ carpus	“ 12.7 “ 11.0
“ chela	“ 1.1 “ 1.1
“ third pair of legs	34.0
“ fifth pair of legs	27.5
“ telson	18.5

Station 339, N. Lat. 38° 16′ 45″, W. Long. 73° 10′ 30″, 1186 fathoms.

Rhachocaris longirostris, sp. nov.

Plate V. Fig. 1. Plate VI. Fig. 1.

Female. — This species agrees with *R. Agassizii* in having the dactyli of the fourth and fifth pairs of thoracic legs slender, but in the sculpturing of the carapax and abdomen it is more like *R. sculpta*, though the tubercles are fewer in number and are all obtuse; it differs very conspicuously from both these species in having a much longer rostrum, longer telson, much shorter antennal scales, and the eyes on shorter peduncles, and, in the alcoholic specimen, devoid of colored pigment.

The rostrum is slightly longer than the rest of the carapax along the dorsal line; the basal two-thirds is horizontal, but the tip strongly upturned; the upper side is flat and the horizontal portion of uniform breadth, but the tip regularly tapered and acute; there is a slight median carina the whole length; there are lateral spines and the corresponding pair of spines at the base of the rostrum as in *R. sculpta*, though a little less prominent; and between the lateral spines and the curved tip the surface is irregularly corrugated. The inferior edge of the rostrum is grooved, the groove being broadest at the beginning of the curved portion, and toward the tip there is in addition a slight median carina. The carinæ of the carapax have nearly the same arrangement as in *R. sculpta*. The tubercles of the indistinct dorsal carinæ are all very low, obtuse, and punctate, and the space between the carinæ unarmed except by a few small tubercles in front. On the lateral lobes of the gastric region the tubercles are all low and obtuse, the anterior being no more prominent than the others. The antennal spine is nearly as in *R. sculpta*, but the spine of the anterior angle is shorter and stouter than in that species, and directed straight forward as in *R. Agassizii*. The lateral carina of the antennal region is continuous and terminates anteriorly in a distinct tooth back of which the edge is obtuse and punctate. Back of the cervical suture, the upper lateral carina is prominent, but the tubercles with which it is surmounted, though more prominent than the others on the carapax, are all obtuse and punctate. The middle lateral carina is continuous, broad, and punctate, and the lower carina is very low but well marked by being punctate. The inferior margin of the carapax is carinated as in the other species.

The eyestalks are very short so as to be almost entirely concealed, and the eyes themselves relatively about as broad as in the other species, but somewhat flattened anteriorly so that they appear much less prominent, and in the alcoholic specimen are perfectly white.

The peduncles of the antennulæ reach only to about the middle of the rostrum and the flagella fall short of its tip, but the proportions of both peduncles and flagella are very nearly as in the other species. The antennal scales scarcely reach to the tips of the peduncles of the antennulæ, are ovate, about three fifths as broad as long, broadest distally, and have a very indistinct tooth about the middle of the outer margin which is only obscurely ciliated back of the tooth.

The external maxillipeds and the first pair of thoracic legs are slightly shorter, reaching scarcely to the tips of the antennal scales, but otherwise as in *R. sculpta*. The thoracic legs of the second pair are similar to those of *R. sculpta*, but the right reaches a little beyond the tip of the antennal scale and its carpus has about twenty-one segments ; the left is a little shorter than the right and its carpus has about eighteen segments. The third legs are nearly as in the other species, reach a little beyond the tips of the antennal scales, and their dactyli are about a third as long as the propodi and very slender. The fourth and fifth pairs of legs are but very little if at all stouter than the third, the fascicles of setæ at the tips of the propodi are nearly as long as the propodi themselves, and the propodi are slightly shorter than in the third pair, strongly compressed as in *R. Agassizii*, but slender and not expanded at all in the middle.

The sculpturing of the abdomen resembles that of *R. sculpta*, but the dorsal carina is less prominent and more obtuse, and the tubercles are fewer in number, obtuse, and punctate. The marginal spines of the epimera of the second to the fifth somite are all short, dentiform, and the posterior spine of the fifth epimeron is merely represented by an obtuse angle. The lateral spines of the sixth somite are about as prominent and fully as stout as in *R. sculpta.*

The telson is longer than the carapax along the median line, exclusive of the rostrum, and has nearly the same form and sculpturing as in *R. sculpta*, though the tip is slightly more upturned. The outer lamella of the uropod is only about two thirds as long as the telson, fully a third as broad as long, with the lateral spine farther from the tip than in the other species and the margin between the spine and the tip obliquely truncated rather than rounded. The inner lamella is narrow and considerably longer than the outer.

The specimen on which the above description is based is not carrying eggs, and the genital orifices at the bases of the third pair of thoracic legs are not easily discoverable; but the appendages of the first and second somites of the abdomen are like those of *R. sculpta*, and leave no doubt in regard to the sex.

Length from tip of rostrum to tip of telson	54.0 mm.
" of carapax including rostrum	23.0
" of rostrum	12.3
Breadth of carapax in front, including spines	8.7
" " at cervical suture	7.0
" " in middle	8.5
Length of antennal scale	4.9
Breadth of antennal scale	3.0
Diameter of eye	2.5
Length of telson	11.0

Station 330, N. Lat. 31° 41′, W. Long. 74° 35′, 1047 fathoms.

From Station 315, N. Lat. 32° 18′ 20″, W. Long. 78° 43′, 252 fathoms, there is a single small and imperfect specimen, evidently the young of this species. This specimen is about 25 mm. long and differs from the one above described in having the carinæ of the carapax a little sharper; the lateral carina of the antennal region interrupted in the middle; the marginal teeth of the abdominal epimera smaller in proportion and the posterior tooth of the fifth epimeron wholly wanting, leaving it bidentate like the third and fourth; and the right and left carpi in the second pair of thoracic legs of about eighteen and fifteen segments respectively.

PALÆMONIDÆ.

ALPHEINÆ.

Hippolyte Liljeborgii Danielssen.

Hippolyte Liljeborgii Danielssen, Nyt Magazin Naturv., Christiania, XI. p. 5, 1861.
Metzger, Jahresber. Comm. wissensch. Untersuchung deutschen Meere, 1872–73, Nordsee, p. 290, 1865 (*Lilljeborgi*).
Danielssen and Boeck, Nyt Magazin Naturv., Christiania, XIX. p. 196, Pl., figs. 15–20, 1872.
Hippolyte securifrons Norman, Trans. Tyneside Naturalists' Field Club, V. p. 267, 1863 (teste Danielssen and Boeck, Metzger).
Smith, Trans. Conn. Acad., V. p. 69, Pl. X. fig. 3, 1879 ; Proc. National Mus., Washington, III. p. 437, 1881.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
303	41° 34′ 30″	65° 54′ 30″	306	8 ♀
306	41° 32′ 50″	65° 55′ 0″	524	2 ♀
309	40° 11′ 40″	68° 22′ 0″	304	2 ♀

This species appears to be abundant in deep water off the whole New England coast. It has also been taken off the Capes of the Delaware by Capt. Z. L. Tanner, of the U. S. Fish Commission Steamer "Fish-Hawk," Station 1045, N. L. 38° 35′, W. Long. 73° 13′, 312 fathoms, and at neighboring stations.

Hippolyte Phippsii Kröyer.

Hippolyte Phippsii Kröyer, Naturh. Tidssk., III. p. 575, 1841 (♂).
Hippolyte turgida Kröyer, Ibid., p. 575, 1841 (♀).
Hippolyte vibrans Stimpson, Ann. Lyceum Nat. Hist. New York, X. p. 125 (♂, var.).
Hippolyte Ochotensis Brandt, Middendorff's Sibirische Reise, II. p. 120, Pl. V. fig. 17, 1849 (♀).

Station 302, N. Lat. 41° 30′, W. Long. 66° 3′, 73 fathoms ; one male.

Hippolyte polaris Ross.

Alpheus polaris Sabine, Suppl. to Appendix of Parry's First Voyage, p. ccxxxviii. Pl. II. figs. 5–8, 1824.
Hippolyte polaris J. C. Ross, in John Ross, Appendix to Second Voyage, p. lxxxv., 1835 (♀).
Hippolyte borealis J. C. Ross, in John Ross, *op. cit.*, p. lxxxiv. Pl. B, fig. 3, 1835 (♂).

Station 303, N. Lat. 41° 34′ 30″, W. Long. 65° 54′ 30″, 306 fathoms ; one male.

Caridion Gordoni Goës.

Hippolyte Gordoni BATE, Nat. Hist. Review, V., Proc., p. 51, figs., 1858. [No specific name is given in the article, though the species is said to be named after its discoverer, the Rev. G. Gordon, but *Hippolyte Gordoni* is given in the "Index to the Proceedings," p. iv.]

Doryphorus Gordoni NORMAN, Ann. Mag. Nat. Hist., 3d Series, VIII. p. 277, Pl. XIII. figs. 6, 7, 1861. [The generic name preoccupied.]

Caridion Gordoni GOËS, Öfversigt Vetenskaps-Akad. Förhandlingar, Stockholm, 1863, p. 170 (10).

Station 311, N. Lat. 39° 59′ 30″, W. Long. 70° 12′, 143 fathoms, sand; two specimens, male and female.

Bythocaris, sp. indet.

A few specimens from Station 314, N. Lat. 32° 24′, W. Long. 78° 44′, 142 fathoms; and Station 327, N. Lat. 34° 0′ 30″, W. Lon. 76° 10′ 30″, 178 fathoms.

The species is the same as the one I have referred to as taken off Block Island by the U. S. Fish Commission (Proc. National Mus., Washington, III. p. 437, 1881). It is apparently closely allied to *B. Payeri* G. O. Sars (Archiv Mathem. Naturvid. Kristiania, II. p. 340, 1877, *Hippolyte Payeri* Heller), but the specimens are all much smaller thon the one described by Heller, none of them being over 30 mm. in length, and probably belong to a distinct species.

Anchistia tenella, sp. nov.

Plate IX. Figs. 1-1^b.

This species is represented by a single specimen, an egg-carrying female. The integument is very thin and soft, so that it is difficult to make out accurately the proportions of the carapax, which is apparently slightly compressed laterally. The rostrum is slender, falls slightly short of the tips of the antennal scales, is fully three fourths as long as the rest of the carapax along the dorsal line; the dorsal crest extends back a short distance upon the carapax, is directed slightly downward through its whole length, and is armed with nine teeth, crowded posteriorly but more widely separated anteriorly, and of which three are back of the orbit and the small anterior one near the acute tip; the lower edge is armed with three teeth. The anterior margin projects in an acute angle below the orbit, and there are well-developed antennal and hepatic spines. Just back of the dorsal crest there is a slight notch in the dorsum with a distinct but short transverse sulcus turned forward either side.

The eyes are small, black, and fall considerably short of the middle of the rostrum. The peduncle of the antennula (Pl. IX. fig. 1^a) reaches to the tip of the rostrum: the first segment is squamiform, about once and two thirds as long as the two distal segments together, about three sevenths as broad as long, and the outer margin is armed with an acute tooth near the middle and projects distally in a similar tooth half as long as the second segment; the second and third segments are subequal in length, the second less than half as wide as the first but with a slight carina-like expansion on the outer side, while the third is still narrower and nearly cylindrical. The outer flagellum is divided for nearly half the length of the outer portion, which is as long as the peduncle, rather stout and somewhat hairy, while the inner ramus is more slender, nearly naked, and extends more than half the length of the whole flagellum beyond the tip of the outer ramus. The inner flagellum is very slender and apparently a little shorter than the outer, but is imperfect at the tip. The antennal scale (Fig. 1^b) is about as long as the rostrum, more than a third as broad as long, only very slightly narrowed distally, and the broad obliquely truncated and rounded tip extends considerably beyond the large and acute spine in which the outer margin terminates. The terminal segment of the peduncle is slender and about two fifths as long as the scale. The flagellum is nearly as long as the whole body of the animal.

The external maxillipeds reach to the middle of the antennal scales and are very slender; the first of the three segments of the endopod reaches to the front edge of the carapax, and the second and third are successively a little shorter. The exopod is slender and reaches a little by the first segment of the endopod. The two pairs of chelate legs are unsymmetrical, the legs of the left side being larger than those of the right. This is very likely accidental, however, for the right antennal scale is short and misshapen, evidently reproduced after injury, and the right chelate legs have very likely been reproduced also, although they are as well formed as the left ones. The left leg of the first pair is about as long as the carapax including the rostrum; the merus and carpus slender and subequal in length; the chela nearly as long as the carpus, and slender, six or seven times as long as broad and with slender and slightly curved digits nearly half the whole length. The right leg is slightly smaller than the left, but the proportion of the parts the same. The left leg of the second pair is once and a half as long as that of the first pair; the ischium and merus are subequal in length, the latter reaching as far forward as the tip of the rostrum; the carpus is a little more than half as long as the merus, and shorter than in the first pair; the chela is nearly as long as the carpus and merus together, slender, though slightly swollen in the middle, and with slender digits about two fifths the whole length. The right leg is about a fourth shorter than the left, and slender in proportion. The third and fourth pairs of legs are alike, slender, about a third longer than the carapax including the rostrum, the carpi about two thirds as long as the meri, the propodi considerably longer than the carpi, and the dactyli slender, slightly curved, acute, and only a sixth or seventh as long as the propodi.

The epimeron of the first somite of the abdomen is very broad, but little narrower than that of the second, and extends far forward by the posterior edge of the carapax ; the second epimeron is orbicular, broader than high and nearly as broad as the whole height of the somite ; the third epimeron is broad and rounded posteriorly ; the fourth epimeron is prolonged backward nearly the full length of the fifth somite and is evenly rounded posteriorly ; the fifth is rounded and projects very slightly posteriorly. The sixth somite is nearly twice as long as the fifth, and about half as high as long. The telson is nearly a third longer than the sixth somite, thin and lamellar, tapers regularly to a rounded tip unsymmetrically armed with five spines and perhaps not quite perfect, and above is evenly rounded and armed with two pairs of aculei. The lamellæ of the uropods reach a little by the tip of the telson : the inner is narrowly ovate and nearly four times as long as broad ; the outer is less than three times as long as broad, and broadly rounded at the tip, which projects much beyond the tooth in which the thickened outer margin terminates.

The eggs, which are well advanced toward maturity, are approximately 0.60 and 0.45 mm. in greater and less diameter in the alcoholic specimen.

All the oral appendages agree very closely with those of *Palæmonetes varians* (Leach sp.) and the number and arrangement of the branchiæ are apparently the same as in that species, though I am not certain that there is more than one arthrobranchia at the base of the external maxilliped. [*Palæmonetes varians* and *Leander natator* have the same branchial formula as *Palæmon squilla.*]

The single specimen is from Station 316, N. Lat. 32 7′, W. Long. 78° 37′ 30″, 229 fathoms, bottom of pebbles, and gives the following measurements : —

Sex		♀
Length from tip of rostrum to tip of telson		25.0 mm.
“ of carapax including rostrum		9.3
“ of rostrum		3.8
“ of antennal scale		3.7
Breadth of “ “		1.4
Length of first pair of legs	right, 8.9 ;	left, 9.5
“ chela	“ 1.8	“ 2.0
“ second pair of legs	“ 11.5	“ 15.0
“ ischium	“ 2.4	“ 3.1
“ merus	“ 2.5	“ 3.3
“ carpus	“ 1.5	“ 1.8
“ chela	“ 3.7	“ 5.0
“ dactylus	“ 1.5	“ 2.0
“ third pair of legs		12.5
“ propodus		3.5
“ dactylus		0.5
“ sixth somite of abdomen		3.0
Height of “ “ “		1.5
Length of telson		4.3

PANDALINÆ.

Pandalus propinquus G. O. Sars.

G. O. Sars, Vidensk.-Selsk. Forhandl. Christiania, 1869, p. 148 (4); Ibid., 1871, p. 259 (16).

Smith, Proc. National Mus., Washington, III. p. 437, 1881.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
306	41° 32′ 50″	65° 55′ 0″	524	2
309	40° 11′ 40″	68° 22′ 0″	304	12

This species is not uncommon in deep water off the New England coast, and is found at least as far south as off the Capes of the Delaware, where it has been taken in abundance by Capt. Z. L. Tanner, of the U. S. Fish Commission steamer "Fish-Hawk," Station 1045, N. Lat. 38° 35′, W. Long. 73° 13′, 312 fathoms.

Pandalus leptocerus Smith.

Proc. National Mus., Washington, III. p. 437, 1881.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
301	41° 26′ 55″	66° 3′ 0″	71	2
302	41° 30′ 0″	66° 0′ 0″	73	7
303	41° 34′ 30″	65° 54′ 30″	306	25±
304	41° 35′ 0″	65° 57′ 30″	139	1
311	39° 59′ 30″	70° 12′ 0″	143	14
344	40° 1′ 0″	70° 58′ 0″	129	2
346	40° 25′ 35″	71° 10′ 30″	44	1

This species almost entirely replaces *P. Montagui* south of Cape Cod, and appears to be everywhere exceedingly abundant in from 30 to 200 fathoms, but below 300 fathoms it seems to give place to *P. propinquus*.

In size and general appearance it is much like *P. Montagui* but more slender and readily distinguished from it, and from *P. propinquus* and *borealis* as well, by the minutely roughened surface and the presence of exopods upon the external maxillipeds.

The rostrum is from about once and a third to nearly twice as long as the rest of the carapax, and curved very slightly upward, but usually not as much so as in *P. Montagui*. Above, it is armed with eleven to thirteen teeth, of which one is near the tip, as in *P. Montagui*, and usually only two back of the orbit on the carapax proper, while a considerable space back of the terminal spine is unarmed, though this space is usually shorter than in *P. Montagui*. Beneath, there are six to eight teeth, as in *P. Montagui*. The entire surface of the carapax and abdomen is slightly roughened with short and irregular, transverse punctate ridges, which give rise to very short bristle-like hairs, while in *P. Montagui, propinquus,* and *borealis* the surface is naked and very smooth. The carapax is considerably more slender than in *P. Montagui,* and the posterior tooth of the dorsal carina is farther forward, being much in front of the middle. The abdomen is more slender than in *P. Montagui;* but, except for the greater slenderness, there is scarcely any difference in the form or proportions of the somites, or the form and armature of the telson and uropods. There are slender exopods, about a third as long as the ischia, at the bases of the external maxillipeds, but the endopods themselves are as in *P. Montagui;* the merus reaches to the base of the flagellum of the antenna, and the tip falls considerably short of the tip of the antennal scale.

The legs of the first pair are nearly as in *P. Montagui.* The right chelate leg of the second pair is shorter and stouter than in *P. Montagui,* and scarcely reaches the tip of the corresponding leg of the first pair ; the ischium is about a fourth the entire length ; the merus is only a little shorter than the ischium ; the carpus increases in thickness distally, is a little longer than the ischium, not more than about once and a half as long as the merus, and usually composed of only five segments, the proximal half being wholly unsegmented or annulated, then three subequal and very distinct segments, about as broad as long, and these followed by the terminal segment, which is about as long as the three next preceding ; the chela is about half as long as the carpus, and a little stouter than its distal end. The left chelate leg is a little shorter and stouter than in *P. Montagui,* but has about the same number of segments in the merus and carpus, and does not differ in other respects. The third, fourth, and fifth pairs of legs differ from those of *P. Montagui* in being a little more slender, and in having much longer, much more slender, and nearly cylindrical dactyli, which are wholly unarmed, except a few small spinules beneath near the base.

The branchial formula is the same as in *P. Montagui.*

Pandalus tenuipes Smith.

Proc. National Mus., Washington, III. p. 441, 1881.

Plate XIII. Fig. 12.

Station 314, N. Lat. 32° 24′, W. Long. 78° 44′, 142 fathoms ; one male and one young specimen, both imperfect.

This species is smaller but has a proportionally thicker body than *P. Montagui,* and the surface of the carapax and abdomen is very minutely roughened, somewhat as in *P. leptocerus,* but the punctate ridges are much less conspicuous and much more thickly crowded than in that species.

The carapax, including the rostrum, is about two fifths of the entire length, and the carapax proper is nearly as long as the rostrum, slightly swollen in the middle, somewhat contracted in front, as seen from above, and with the rostral carina extending back to about the middle, and armed, at about a third of the way from the orbit to the posterior margin, with two to four slender spines crowded close together, rapidly decreasing in size posteriorly and *movably articulated* with the carapax ; but between these teeth and the posterior teeth of the rostrum the carina is wholly unarmed. The rostrum is curved upward a little more than in *P. Montagui*, is not expanded below, and is armed the whole length above with eight to ten teeth, which are usually more widely separated distally, though in some specimens the terminal two or three are crowded together near the tip ; beneath there are six to ten small teeth.

The eyes are black and as broad as long, but shorter than in *P. Montagui.* The peduncle of the antennula reaches to near the middle of the antennal scale, and the two distal segments are subequal in length and each about as broad as long. The antennular flagella are subequal in length and much longer than the carapax, including the rostrum ; the proximal half of the outer flagellum is very much thickened, the terminal portion very slender, as is the inner flagellum throughout. The antennal scale is approximately four fifths as long as the rostrum, and of very nearly the same form as in *P. Montagui.* The oral appendages differ from those of *P. Montagui* in the following particulars : the proximal segment of the mandibular palpus is dilated, though not quite as conspicuously as in *P. Montagui ;* the posterior lobe of the scaphognath of the second maxilla is very short, broad, obtusely rounded at the extremity, and projects very little back of the base of the endognath, while in *P. Montagui* and the allied species it is very much prolonged and acutely triangular posteriorly ; in the second maxilliped the dactylus is about as long as broad, and articulated with the oblique distal end of the propodus (Pl. XIII. fig. 12), while in *P. Montagui* and its allies the dactylus is a narrow plate, articulated by one edge to the distal part of the mesial edge of the propodus. The external maxillipeds are very slender, reach to about the tip of the rostrum, and have well-developed exopods, fully half as long as the ischium ; the ischium is a little longer than the rest of the endopod, which is composed, as in *P. Montagui*, of only two distinct segments beyond the ischium, and in this case these two segments are subequal in length.

The legs of the first pair are very slender, and reach to the tips of the external maxillipeds. The second (chelate) legs are exactly alike, and reach to or considerably by the tips of the antennal scales. The ischium is a little longer than the merus ; the carpus is a little less than twice as long as the merus, slightly shorter than the antennal scale, and composed of about fifteen segments, of which the proximal are separated by indistinct, but the four or five distal by conspicuous articulations, while the ultimate is about twice as long as broad, and the next three or four, each, only about half as long as broad. The chela is slender, only a very little stouter than the distal end of the carpus, nearly a third as long as the carpus, and about half as long as the merus, and the digits are alike, about as long as the basal portion, slightly gaping, and with a very few long, setiform hairs. The third, fourth, and fifth pairs of legs are exceedingly slender, sparsely armed with minute spinules and slender setæ ; and the dactyli are very long and slender, slightly and regularly bent, and flattened a little vertically (or in the direction of the plane of the curvature), and wholly unarmed; those of the fifth pair reach beyond the tip of the rostrum, and the fourth and third pairs are successively a little longer; the dactylus in the fifth pair is a third or a little more than a third as long as the propodus, in the fourth pair a little longer than in the fifth, and in the third pair not far from half as long as the propodus.

The abdomen is evenly rounded and not at all compressed above, and less geniculated at the third segment than in *P. Montagui*. The sixth segment is about once and two thirds as long as the fifth. The telson is about once and a half as long as the sixth segment, and terminates in an acutely triangular tip, armed each side with two long spines, of which the proximal is very much the longer, and at the extreme tip with a few long, plumose setæ.

The branchial formula is the same as in *P. Montagui*.

Pandalus acanthonotus, sp. nov.

Plate XIII. Figs. 10, 11.

This species, of which there is but one specimen in the collection, is closely allied to *P. tenuipes*, but is at once distinguished from it by the deeper and nearly horizontal rostrum with the dorsal teeth forming a continuous series with the spines on the dorsal crest of the carapax; and by the much longer sixth somite of the abdomen, which is more than twice as long as the fifth somite, and longer even than the telson.

Female. — The carapax including the rostrum is only about a third of the entire length, somewhat contracted in front as seen from above, and with the rostral carina extending back to about the middle, but not sharp except in front, where it is armed with five slender spines *movably articulated* with the carapax and closely crowded together. The rostrum is considerably shorter than the carapax proper, nearly horizontal, expanded below, tapers to an acute tip, is armed above with seven teeth, of which the anterior is very minute and a little way from the tip while posteriorly the teeth become slender and at last spiniform, almost like the spines of the carapax, with which they form a continuous series; below, the edge is armed with six teeth, of which the anterior one is minute and situated a little back of the tip.

The eyes are large, pyriform, and black, and, as well as the antennulæ and antennæ, are nearly as in *P. tenuipes*.

The oral appendages are all very nearly as in *P. tenuipes;* the propodus in the second maxilliped (Pl. XIII. fig. 11) is, however, a little larger proportionally, and the very narrow dactylus articulated along nearly half the length of the mesial edge of the propodus very much as in *P. Montagui*, while in *P. tenuipes* the dactylus is about half as long as broad and articulated with the oblique distal end of the propodus. The external maxillipeds reach a little by the tips of the antennal scales, are almost exactly as in *P. tenuipes*, and, as in that species, have well developed exopods half as long as the ischia. The oral appendages do not differ very much from those of *P. carinatus* figured on Plates X. and XI.: the first maxillæ and second maxillipeds are almost exactly as in *P. carinatus;* the distal segment of the mandibular palpus is broader and more obtuse at the tip, but in other respects the mandibles do not differ; the second maxillæ differ only in having the posterior division of the distal lobe of the protognath proportionally a little smaller; the first maxillipeds are similar to those of *P. carinatus*, but the lamellar portion of the exopod is a little broader and more abruptly narrowed into a more slender flagelliform portion; the external maxillipeds are more slender than in *P. carinatus*, and the two distal segments are subequal in length.

The legs of the first pair reach to the tips of the external maxillipeds and are as in *P. tenuipes*. The second (chelate) legs are very nearly alike, but the left is a little longer than the right and reaches to about the tip of the antennal scale; both are about equally slender; the carpi are more than a third of the entire length, segmented throughout but more conspicuously distally, and composed of about twenty segments, of which the most distal one is considerably longer than broad, but all the others shorter than this and approximately equal in length; the chelæ are alike, scarcely stouter than the carpus and only a little more than twice as long as its distal segment. The third, fourth, and fifth pairs of legs are nearly as in *P. tenuipes:* those of the posterior pair reach considerably by the tip of the rostrum, and the fourth and third are successively a little longer; the meri are sparsely armed with small spines, but the distal segments unarmed excepting a few setæ or hairs; the dactylus in the third pair is about a third as long as the propodus, and in the fourth pair about a fourth as long as the propodus.

The abdomen is rounded above, but is rather strongly geniculated and slightly compressed at the third somite. The sixth somite is more than twice as long as the fifth, longer even than the antennal scale or rostrum, and strongly compressed.

The telson is much shorter than the sixth somite, slender, and terminates, as in *P. tenuipes*, in a triangular tip armed each side with two long and slender spines of which the proximal is much the longer.

The surface of the carapax and abdomen is minutely roughened, as in *P. tenuipes*, by thickly crowded irregular transverse punctate ridges.

The branchial formula is apparently just as in *P. tenuipes*, *P. Montagui*, etc., and as in the following species, *P. carinatus*.

MEASUREMENTS.

Station	321
Sex	♀
Length from tip of rostrum to tip of telson	42.0 mm.
" of carapax including rostrum	14.2
" of rostrum	6.3
Breadth of carapax	4.9
Length of antennal scale	5.6

Breadth of antennal scale	1.3 mm.
Length of right chelate leg	11.5
" carpus	4.2
" chela	1.0
" left chelate leg	13.5
" carpus	5.4
" chela	1.0
" third leg	19.0
" fifth leg	18.5
" fifth somite of abdomen	3.0
" sixth somite of abdomen	7.0
Height of " " "	2.7
Length of telson	5.2

Station 321, N. Lat. 32° 43′ 25″, W. Long. 77° 20′ 30″, 233 fathoms.

Pandalus carinatus, sp. nov.

Plate X. Figs. 2-2f. Plate XI. Figs. 1-3.

Female. — The surface of the carapax and abdomen is microscopically punctate for the insertion of very minute hairs. The carapax including the rostrum is about as long as the entire abdomen, but the carapax proper much shorter than the rostrum and armed with a high dorsal crest nearly the whole length and with four sharp and very conspicuous longitudinal carinæ each side. The rostrum is very slender, nearly horizontal toward the base and slightly upturned from a little back of the middle, and armed above, from near the slender and acute tip, with thirteen conspicuous teeth in front of the orbit and four more on the anterior half of the carapax, and beneath from near the tip to the front of the eye with nine similar teeth. The uppermost of the four lateral carinæ is in a line straight back from the middle of the orbit, but is interrupted by a slight depression and terminates in a small tooth just back of the middle, and is not conspicuous on the anterior half of the carapax; the second and third carinæ are continuous the whole length of the carapax, nearly parallel and slightly curved, the upper terminating anteriorly in a conspicuous antennal spine just over the base of the antenna, the lower in a similar but laterally more prominent spine below the base of the antenna; the lowest carina is a marginal carina of the inferior edge of the carapax, which is more strongly incurved than in the typical species of *Pandalus.*

The eyes are rather small for the genus, pyriform, and black. The first segment of the peduncle of the antennula is broad, squamiform, excavated for the reception of the eye, and furnished externally with a large lamellar process terminating anteriorly in an acute angle in front of the eye. The second and third segments are very short, taken together being scarcely longer than their diameter. The outer flagellum is a little more than twice as long as the peduncle, the basal half considerably thickened and hairy, but the terminal portion exceedingly slender. The inner flagellum is considerably longer than the outer, reaches nearly to the tip of the rostrum, and is slender throughout. The antennal scale is about three fourths as long as the carapax excluding the rostrum, and near the base about a fourth as broad as long, but tapers distally to an acute tip. The second segment of the peduncle of the antenna is armed with a triangular tooth above the base of the scale and with a long spine below. The flagellum is slender, and considerably longer than the carapax including the rostrum.

The mandibles (Pl. XI. fig. 1) are nearly as in *P. Montagui*, though the proximal segment of the palpus is much less dilated, and all the segments are only sparsely armed with setæ ; the mandibles are in fact more nearly as in *P. tenuipes*. The first maxillæ (Fig. 2) are essentially as in *P. Montagui*. The lobes of the protognath and the endognath of the second maxilla (Fig. 3) are nearly as in *P. Montagui*, but the scapognath is very different ; its posterior lobe is short, broad, and evenly rounded, much as in *P. tenuipes*, while the anterior lobe is much longer than the posterior, fully as broad, and with a broad and truncated extremity ; both extremities of the scaphognath are margined with very long plumose setæ, while those upon the edges between are short. The first and second maxillipeds (Pl. X. figs. 2^a, 2^b) do not differ essentially from those of *P. Montagui*. The external maxillipeds have well-developed exopods about two thirds as long as the ischium, which is more than half the entire length of the endopod ; the terminal segment of the endopod is considerably longer than the penultimate, and tapers to an acute point.

The legs of the first pair are more slender than the external maxillipeds, and do not quite reach to their tips. The right chelate leg (Pl. X. fig. 2^c) reaches a little by the base of the antennal scale, and is rather stouter than usual in the genus ; the merus and carpus are subequal in length, and the carpus is rather obscurely divided into about eight segments, of which the proximal and distal are much longer than the others ; the chela is very little shorter than the carpus and much stouter, and somewhat swollen so that it is between a third and a fourth as broad as long ; the digits are rather stout, slightly curved, and more than a third of the entire length.

The three last pairs of legs are slender, subequal in length, reach to about the tips of the first pair, are armed with numerous setæ and slender spines, and the dactyli are slender, very slightly curved, and about a third as long as the propodi.

The first, second, fifth, and sixth somites of the abdomen are evenly rounded above, but the third and fourth are armed with a sharp dorsal carina, most conspicuous on the third somite, and in both somites projecting backward over the succeeding somite in a prominent horizontal and acute tooth. The first epimeron projects downward even below the second, which is orbicular and about as broad as high ; the third and fourth epimera project backward in evenly rounded lobes, but the fifth in an acute angle.

The telson is about as long as the fifth and sixth somites together, narrow, armed with four pairs of dorsal aculei, and the triangular tip (Pl. X. fig. 2^f)

with three pairs of spines, of which the terminal are small and slender, the next very long, and the anterior short and stout. The lamellæ of the uropods are about as long as the telson: the inner is lanceolate and between four and five times as long as broad; the outer is between three and four times as long as broad, with the tip broad, somewhat obliquely rounded, and projecting considerably beyond the acute tooth in which the outer margin terminates, and just inside the base of which there is a spine much longer than the tooth itself.

The outer lamella of the appendage of the first somite of the abdomen is a little longer than the protopod, about a sixth as broad as long, and margined with multiarticulate plumose setæ as usual, while the inner lamella is a little less than half as long as the outer, expanded externally near the base, where the breadth is equal to about a fourth the length, but tapering and slender distally, and margined with plumose setæ like the outer. The inner lamella of the appendage of the second somite is a little longer than the outer lamella of the appendage of the first somite, between six and seven times as long as broad, and bears, a little way from the base, the usual stylet, which is about a fifth as long as the lamella itself.

The single specimen is from Station 327, N. Lat. 34° 0′ 30″, W. Lon. 76° 10′ 30″, 178 fathoms, and gives the following measurements: —

Sex	♀
Length from tip of rostrum to tip of telson	48.0 mm.
" of carapax including rostrum	24.0
" of rostrum	15.2
Breadth of carapax	5.2
Length of antennal scale	7.1
Breadth of " "	1.8
Length of right chelate leg	9.2
" carpus	2.2
" chela	1.9
" left chelate leg	12.3
" carpus	4.8
" chela	1.2
" sixth somite of abdomen	4.3
Height of " " "	2.2
Length of telson	6.1

The genus *Pandalus*, as at present recognized, apparently contains species representing several genera, and this species is probably not strictly congeneric with *P. Montagui*, the type species. The carinated carapax gives the species a very different aspect from the typical *Pandali*, but the appendages throughout, excepting the scaphognath of the second maxilla, are very nearly as in *P. Montagui*, and the number and arrangement of the branchiæ are the same as in that species, *P. propinquus*, *borealis*, *leptocerus*, and *tenuipes*, or as indicated in the following formula.

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	1	1	1	1	1	0	(7)
Podobranchiæ,	0	1	0	0	0	0	0	0	1
Arthrobranchiæ,	0	0	2	1	1	1	1	0	6
Pleurobranchiæ,	0	0	0	1	1	1	1	1	5
									12+(7)

This species will evidently fall in Milne-Edwards's genus *Heterocarpus* (Ann. Sci. Nat., 6^{me} series, XI. No. 4, p. 8, 1881), of which the description has been published since the above was written, and it appears to be closely allied to, but distinct from, his *H. ensifer*, from 218 fathoms near Barbadoes. Milne-Edwards has however misapprehended the affinities of the genus, of which he says: "Les crustacés du genre *Heterocarpus* offrent certaines analogies avec les Oplophorus et, par d'autres caractères, ils se rapprochent des Lysmates, des Hippolytes et des autres crustacés de la même famille." The genus is very near *Pandalus*, certainly far nearer than to *Oplophorus* (of which, however, I have never examined specimens), or any other described genus. *Heterocarpus* should be placed with the two or three genera into which the genus *Pandalus* as it now stands must sooner or later be divided, and the species which I have here described should then stand as *Heterocarpus carinatus*.

EPHYRINÆ.

MIERSIA Kingsley.

Ephyra Roux (nom. præoc.).

As far as I know, the only described species properly referred to this genus are *M. pelagica* and *punctulata* (Risso sp.), both apparently unknown to modern carcinologists, and *M. Hæckelii* (*Ephyra Hæckelii* Von Martens), all from the Mediterranean. *Ephyra compressa* De Haan, placed in *Miersia* by Kingsley, had already been referred to *Atyephyra* by Von Martens (Archiv fur Naturgesch., XXXIV., 1868, p. 51, Pl. I. fig. 4^{a} to 4^{c}), and is certainly not closely allied to the species here described nor to *M. Hæckelii.*

A new genus, *Meningodora*, described beyond, and *Hymenodora* G. O. Sars, are in most characters closely allied to *Miersia*, and are here referred to the same subfamily, which has little affinity with the Atyidæ, but is in many respects much like *Pandalus*, and has, perhaps, still closer affinity with *Oplophorus* or some of its allies.

Eumiersia, a new genus described beyond, is in some respects intermediate between the genera just mentioned and *Pandalus*, and is only provisionally placed in this subfamily.

Miersia Agassizii, sp. nov.

Plate XI. Figs. 5-7. Plate XII. Figs. 1-4.

Male. — The carapax is nearly as broad as high, but is a little compressed above so as to make the dorsum somewhat obtusely angular, though rounded and not at all carinate even anteriorly. The rostrum is imperfect in all the specimens seen, but in the most perfect specimen it was evidently much longer than the carapax proper ; it is very slender, slightly upturned toward the tip, and back of the tip of the antennal scale is armed with seven teeth above and four beneath. The anterior margin projects in an acute, but scarcely spiniform, angle above the base of the antenna, and opposite the base in an acute and laterally prominent branchiostegial spine, below which the branchiostergite is rather suddenly incurved in the anterior part of the carapax. The surface of the carapax and abdomen is naked and smooth to the unaided eye, but is microscopically punctate.

The eyestalks are very short, and terminated by small hemispherical black eyes. The peduncle of the antennula is short, much less than half as long as the antennal scale : the first segment is fully as long as the second and third taken together, is deeply excavated above for the reception of the eye, and its outer edge is armed distally with a small tooth ; the second and third segments are broader than long and subcylindrical. The outer or major flagellum is nearly twice as long as the antennal scale, with the proximal portion for about half the length of the antennal scale compressed vertically, broadly expanded, and thickly clothed beneath with fine hairs, but the distal portion is very slender and somewhat compressed vertically. The antennal scale is about three fourths as long as the carapax excluding the rostrum, and near the base about a fourth as broad as long, but narrowed regularly to a very slender tip. The second segment of the peduncle is armed with an acute dentiform spine below, and a triangular tooth above the base of the scale. The distal segment of the peduncle reaches only about a third of the way from the base to the tip of the antennal scale. The flagellum is wanting in all the specimens examined.

The labrum is fleshy, prominent as seen in front, and the inferior edge is thickened and slightly indurated and applied to the concave dorsal surfaces of the mandibles. The lobes of the metastome are very broad distally and somewhat truncated. The mandibles (Pl. XII. figs. 1, 1^a) are expanded into thin, dorsally concave and strongly dentate ventral processes, above and closely connected with which are small and narrow molar areas. The opposing edges of the ventral processes differ somewhat on the two sides : on the right side, as shown in the figures, the mesial edge is slightly convex as seen from above or below, and armed with about eight acutely triangular teeth, beyond which there are several small teeth on the anterior edge ; on the left side the mesial edge as seen from above or below is straight or slightly concave, terminates anteriorly in a sharp angle beyond which there are no teeth on the anterior edge, and the teeth on the anterior part of the mesial edge are very small, though back of these small teeth there are about as many and as large teeth as on the mesial edge of the right mandible. The protognathal lobes of the first maxilla (Pl. XII. fig. 2) are approximately equal in size, broad at the ends, and armed as usual with slender spines upon the distal, and numerous setæ upon the proximal lobe. The endognath is small, obtusely pointed, and armed with a very few marginal setæ and with two slender spines upon a small fold on the ventral side near the tip. The protognathal lobes of the second maxilla (Pl. XII. fig. 3) are very unequal, the proximal lobe is broad but very short, while the distal is long and deeply divided into two narrow and obtuse lobes. The endognath is unsegmented, short, and narrowed to a slender tip. The scaphognath projects anteriorly slightly beyond the endognath, and both ends are broad and evenly rounded.

The protopod of the first maxilliped (Pl. XII. fig. 4) projects very little anteriorly, and is obscurely divided into a very small proximal and a large distal lobe. The endopod is well developed, and composed of three segments, of which the proximal is very short, broader than long, the second nearly three times as long as broad, the terminal a little smaller than the second and lanceolately pointed, and all the segments margined with setæ. The exopod is a very large lamelliform lobe longer than the endopod, about a third as broad as long, expanded and broadly rounded in outline distally, and edged with plumose setæ which gradually increase in size distally along the margin. The epipod is small, branchial, with the anterior and posterior parts nearly equal. The ischium in the second maxilliped (Pl. XI. fig. 5^a) is much shorter than broad ; the merus between two and three times as long as broad ; the carpus a little narrower than the merus and about as long as broad ; the propodus bent back upon the merus as in most Palæmonidæ, a little longer than the merus, nearly half as broad as long, and obliquely truncated along the mesial edge for the articulation of the dactylus, which is more than twice as broad as long and armed with setæ and slender spines as is the mesial and anterior edge of the dactylus. The exopod is nearly as long as the endopod, slender, and multiarticulate and flagelliform for more than half its length. The epipod is broad at base, somewhat triangular, and bears a large phillobranchia. The endopod of the external maxilliped reaches a little beyond the middle of the antennal scale, and is slender and composed of three segments, of which the proximal is the longest, reaches as far forward as the antero-lateral angle of the carapax, and is strongly curved and dorsally compressed in the middle opposite the mouth ; the middle and the distal segments are straight, the middle about half as long, and the distal nearly as long, as the proximal ; all the segments are more or less setigerous. The exopod is slender, multiarticulate, flagelliform, and about as long as the proximal segment of the endopod. The epipod is narrow, lamellar, nearly as long as the middle segment of the endopod, and lies between the branchiæ of the ninth and tenth somites.

All the thoracic legs are furnished with exopods like those of the external maxillipeds, and the first, second, and third pairs are furnished also with epipods like those of the external maxillipeds. The first and second pairs of legs are slender, do not reach the tips of the external maxillipeds, and are very nearly alike, but the carpus and chela are a little longer and more slender in the second than in the first pair. In both pairs the merus is a little longer than the ischium, and reaches to or a little by the antero-lateral angle of the carapax. In the first pair the carpus is scarcely more than half as long and about as stout as the merus, and the chela is somewhat longer and a little stouter than the carpus, and with slender slightly compressed and nearly straight digits about a third of the whole length. In the second pair the carpus is scarcely as stout as the merus and about two thirds as long, and the chela is scarcely stouter than the carpus, but considerably longer. The third and fourth pairs of legs are nearly alike and reach by the tips of the external maxillipeds, the lower edges of the meri are spinulose, the propodi considerably longer than the carpi, and the dactyli are slender, nearly straight, unarmed, and nearly a third as long as the propodi. The posterior legs are slightly shorter than the third and fourth, and like them except the distal extremity, which is peculiarly modified. The propodus is slender, about as long as in the third and fourth pairs, is furnished with a few very long plumose setæ near the middle, is thickly armed distally along the lower edge with serrately armed and simple setæ, and so densely clothed at the tip with long setæ as to very nearly hide the dactylus, which is very short, curved at the tip, and armed with several slender spines.

The abdomen is large relatively to the cephalo-thorax, strongly compressed, and dorsally carinated except upon the first somite, the carina being most conspicuous on the third somite, where it projects posteriorly in a very long and slender tooth. There is a similar but much smaller tooth on the three succeeding somites, though in two of the three specimens examined it is nearly or quite obsolete on the fourth somite. The epimera of the four anterior somites are broad and very deep, the height of the abdomen at these somites being as great as or greater than that of the carapax. The first epimeron is as deep as the second, and its anterior edge is slightly concave in outline and projects a little below; the second is about as broad as high, and approximately orbicular; the third and fourth project posteriorly in broadly rounded lobes; the fifth projects posteriorly in an angular lobe obtusely rounded at the tip. The sixth somite is nearly twice as long as the fifth, and about twice as long as high.

The telson is considerably longer than the sixth somite, very slender toward the tip, rounded and slightly sulcated above, and armed with four or five pairs of stout dorsal aculei on the distal half. The outer lamella of the uropod scarcely reaches the tip of the telson, is about four times as long as broad, tapers very slightly except near the tip, which is ovate and projects nearly the width of the lamella beyond the angle in which the thickened outer margin ends; the inner lamella is obtusely lanceolate, and considerably shorter and a little narrower than the outer.

The outer ramus of the appendage of the first somite of the abdomen is long and slender, and like that of the succeeding appendages, but the inner ramus is developed into a broad oval lamella about a third as long as the outer ramus, with both margins setigerous and the inner thickened and bearing a slender stylet armed as usual with minute hooks. The inner ramus of the appendage of the second somite bears the two stylets usually characteristic of the male.

A small and imperfect female specimen appears not to differ from the males as above described except in the usual sexual characters. The inner ramus of the first abdominal appendage is a very small lamella nearly four times as long as broad and furnished with very long and slender setæ.

The surface of the carapax and abdomen is very nearly naked, but is roughened by minute granular projections.

The number and structure of the branchiæ seem to be essentially the same as in the typical species of *Pandalus*, but there is apparently no epipod at the base of the fourth leg, so that the branchial formula is as follows: —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	1	1	1	1	0	0	(6)
Podobranchiæ,	0	1	0	0	0	0	0	0	1
Arthrobranchiæ,	0	0	2	1	1	1	1	0	6
Pleurobranchiæ,	0	0	0	1	1	1	1	1	5
									12+(6)

The most perfect of the three specimens in the collection affords the following measurements: —

Station	330
Sex	♂
Length from tip of rostrum to tip of telson	80+ mm.
" of carapax excluding rostrum	16.0
" of rostrum	16+
" of antennal scale	11.7
Breadth of " "	3.0
Length of sixth somite of abdomen	10.0
Height " " "	5.0
Length of telson	13.0

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
305	41° 23′ 15″	65° 51′ 25″	810	1 ♂.
323	33° 19′ 0″	76° 12′ 30″	457	1 ♀.
330	31° 41′ 0″	74° 35′ 0″	1047	1 ♂.

Miersia gracilis, sp. nov.

Plate XI. Figs. 4 - 4¹.

Young male. — The carapax is slightly compressed, and including the rostrum only a little shorter than the abdomen; the dorsum is rounded posteriorly, but carinated in front of the middle, and rises anteriorly into a high and sharp crest which extends to the base of the rostrum; and the anterior margin is armed as in *M. Agassizii*. The rostrum is considerably longer than the carapax proper, very slender, directed slightly downward for a short distance from the base, and is then nearly horizontal to the very slender and acute tip; is armed above for its whole length with fourteen teeth, of which the four or five posterior are nearer together than the others, and the two posterior very small and back of the orbit on the carapax proper; and is armed below with nine teeth from in front of the eye to the tip.

The eyes are very much larger than in *M. Agassizii*, pyriform, and black. The antennulæ are very nearly as in *M. Agassizii*, but the thickened proximal part of the outer or major flagellum is relatively a little shorter. The antennal scale is about half as long as the rostrum, about three fourths as long as the carapax excluding the rostrum, and of nearly the same form as in *M. Agassizii.*

The labrum and metastome are nearly as in *M. Agassizii*. The mandibles differ from those of *M. Agassizii* in the molar areas being very small, nearly obsolete, and not distinctly separated from the ventral process, which is armed with teeth more uniform in size and not becoming rudimentary anteriorly. The terminal segment of the mandibular palpus is slightly shorter than in *M. Agassizii*, but in other respects the palpus does not differ. The distal lobe of the protognath of the first maxilla is very broad at the prehensile edge, and the lobe is much larger than the proximal lobe; the endopod is more slender than in *M. Agassizii*, is armed with one in place of two spines on the fold near the distal extremity, and is without marginal setæ. The divisions of the distal lobe of the protognath of the second maxilla are much broader distally, presenting much longer prehensile edges, and the scaphognath is narrower than in *M. Agassizii*. The protopod of the first maxilliped is as in *M. Agassizii*, but the exopod and endopod (Pl. XII. fig. 10) differ conspicuously. The endopod is more slender and the distal segment is very much shorter, while the lamelliform exopod has the inner angle of the distal extremity prolonged and indistinctly segmented, thus approximating to the early stages, in which it is doubtless flagelliform. The second maxilliped is as in *M. Agassizii*, except the terminal portion of the endopod (Pl. XI. fig. 4^d) which differs in the same way as that of *Pandalus tenuipes* differs from that of *P. acanthonotus* (Pl. XIII. figs. 11, 12), but to a greater extent, the dactylus being narrow, longer than broad, and transversely articulated with the propodus.

The external maxillipeds and chelate legs are almost exactly as in *M. Agassizii*. The third and fourth pairs of legs are alike, and differ from those of *M. Agassizii* in having shorter carpi scarcely half as long as the meri, propodi about twice as long as the carpi, and dactyli only a very little shorter than the propodi, slender, slightly curved, and armed with a few minute spines. The posterior legs are scarcely three fourths as long as the fourth, but the segments have nearly the same relative proportions except the dactylus (Pl. XI. fig. 4^a), which is about a third as long as the propodus, obtuse at the tip, and armed along the lower edge and at the tip with serrate setæ, of which the terminal ones are much the longer, while the proximal are like those upon the propodus, which is armed with serrate setæ somewhat as in *M. Agassizii.*

The abdomen is a little more slender than in *M. Agassizii,* and the third, fourth, and fifth somites are more conspicuously toothed, but none of the somites are distinctly carinated except the third, which is strongly carinate, or crested, and projects over the fourth somite in a very strong tooth, and the fourth and fifth, which are anteriorly rounded above, and have a short carina-like elevation at the base of the tooth. All the epimera are somewhat smaller than in *M. Agassizii,* but similar in form to those of that species except that the fifth has a distinct tooth in the postero-dorsal edge. The sixth somite is fully twice as long as the fifth, twice as long as high, and strongly compressed laterally.

The telson is a little longer than the sixth somite, about as long as the antennal scale, slender, and tapers to a long and slender tip armed either side with six to eight spines, besides five or six pairs of dorsal aculei above the tip. The lamellæ of the uropods are almost exactly as in *M. Agassizii.*

The inner ramus of the appendage of the first somite of the abdomen (Pl. XI. fig. 4^b) is a little more than a third as long as the slender normal outer ramus, fully three times as long as broad, ciliated along the outer edge, the inner edge straight, and projecting slightly distally, where it is armed with the usual hooklike spines for holding together the appendages of the two sides of the animal. The inner ramus of the appendage of the second somite bears the usual two stylets (Pl. XI. fig. 4^c), but the secondary stylet, specially characteristic of the male, is rudimentary, only about a fifth as long as the other, is terminated with a single long seta, and undoubtedly indicates that the specimen is immature.

The surface of the carapax and abdomen is naked, but thickly and conspicuously punctated.

The branchial formula is apparently the same as in *M. Agassizii.*

The single specimen is from Station 328, N. Lat. 34° 28′ 25″, W. Long. 75° 22′ 50″, 1632 fath., and gives the following measurements : —

Sex	♂
Length from tip of rostrum to tip of telson	44.0 mm.
" of carapax including rostrum	20.0
" of rostrum	12.0
" of antennal scale	6.0
Breadth of " "	1.6
Length of sixth somite of abdomen	5.5
Height of " " "	2.7
Length of telson	6.0

This species is perhaps not congeneric, or consubgeneric, with *M. Agassizii,* but it seems best to refer them both to the present genus until their relations to the typical Mediterranean species of *Miersia* can be better determined.

The form and dentition of the rostrum of *Miersia gracilis* appear to be much like *Acanthephyra debilis* A. Milne-Edwards (Ann. Sci. Nat., 6^{me} series, XI. No. 4, p. 13, 1881), and it is possible that the species may be identical, — or, on the other hand, that they may belong to very different genera. Milne-Edwards says : "Le genre *Acanthephyra* semble rattacher les *Penæus*, les *Regulus*, les *Oplophorus* et les *Ephyra*," but gives no characters which enable me to tell how the genus differs from *Miersia* (*Ephyra*), though the species of *Miersia* appear to be very little known, as I have already remarked, and Milne-Edwards may have had opportunities of examining typical specimens, to which, however, he does not allude. *Miersia Agassizii* is evidently very distinct from any of the species of *Acanthephyra* described by Milne-Edwards.

MENINGODORA,* gen. nov.

Integument throughout very thin and membranaceous. Body compressed laterally and the carapax dorsally carinate anteriorly, with a short triangular rostrum, a well-developed branchiostegial spine as in *Miersia*, and with an antennal and hepatic sulcus, above which there is a carina which is continued back along the dorsal limit of the branchial region, — a form of areolation strongly recalling the Penæidæ. Antennal scales broad and foliaceous, but all the other articular appendages essentially as in *Miersia*. The branchiæ (phyllobranchiæ) have the same structure and arrangement as in *Miersia*, except that there is apparently but one arthrobranchia at the base of the external maxilliped, making in all eleven branchiæ and six epipods each side.

Although differing very conspicuously in general appearance from the species of *Miersia* here described, this genus is very closely allied to them, as a comparison of the figures of the appendages will show, but it is sufficiently distinguished by the characters above given. Its relation to *Hymenodora* † is more obscure, though perhaps equally close. In *Hymenodora* the body is not compressed, and according to Buchholz's figure the epimera of the second somite of the abdomen do not overlap the epimera of the first segment, but are of the same form as the succeeding epimera, and this seems to be confirmed by the clause in Sars's generic diagnosis, "epimeris æqvaliter rotundatis." Moreover, the endopod of the first maxilliped, according to Sars, is not segmented ("parte terminali (propria) angusta, inarticulata"). On the other hand, the number of the branchiæ is apparently the same, though Sars's statement ("branchiæ utrinqve 6, antica et postica simplex, ceteræ bipartitæ ; præterea adsunt branchiæ supplementariæ, indivisæ, laminaceæ, basi maxillipedum 1^{mi} et 2^{di} paris affixæ") does not make this perfectly clear.

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* Μῆνιγξ, *a membrane ;* δορά, *skin.*

† *Hymenodora glacialis* G. O. Sars, Archiv Mathem. Naturvid., Kristiania, II. p. 341, 1877 (*Pasiphaë glacialis* Buchholz, Zweite deutsche Nordpolfahrt, II. p. 279, Pl. I. fig. 2, 1874).

Meningodora mollis, sp. nov.

Plate XI. Figs. 8-9. Plate XII. Figs. 5-9.

Female. — The carapax including the rostrum is about two thirds as long as the abdomen to the tip of the telson, about half as high as long, and considerably compressed; the dorsal carina is high and very sharp in front, gradually diminishes posteriorly, scarcely reaches the posterior margin, and anteriorly extends to the tip of the acutely triangular rostrum, which is about half as long as the antennal scale and only about a seventh as long as the carapax. On the dorsal carina just back of the base of the rostrum there are five or six very indistinct rudimentary teeth scarcely perceptible to the naked eye and too minute to be indicated in the figure. The anterior margin projects in a triangular lobe above the base of the antenna, and is armed below with an acute and laterally prominent branchiostegial spine very much as in *Miersia Agassizii.* From just back of the eye a distinct gastro-antennal and gastro-hepatic carina extends backward and downward and divides, the upper branch continuing back in a gastro- and cardiaco-branchial carina, and the lower turning down in front of the branchial region and limiting a wide antennal and hepatic sulcus behind. The inferior and posterior edges are broadly and evenly curved.

The eyestalks (Pl. XI. fig. 8^a) scarcely reach the tip of the rostrum, are nearly cylindrical, slightly swollen near the base and tapered distally, with a papilla-like tubercle just back of the cornea on the inner side and very small terminal black eyes no thicker than the adjacent stalk.

The first segment of the peduncle of the antennula is about as long as the eye and rather longer than the other two taken together, flattened and somewhat excavated above and with a rather broad lateral lobe terminating in a tooth nearly as far forward as the extremity of the body of the segment itself; the second and third segments are subcylindrical and approximately equal, but the third projects below in a process for the articulation of the lower flagellum far beyond the base of the upper flagellum. The proximal part of the upper flagellum is much stouter than the lower, somewhat compressed, not conspicuously swollen at the base, and hairy along the lower edge. The lower flagellum is very slender, cylindrical, and nearly naked. The antennal scale is rather more than twice as long as the eye, nearly half as broad as long, very thin, foliaceous, slightly narrowed distally, and obliquely truncated at the tip, which extends a little beyond the small tooth in which the slightly curved outer margin terminates. There are no acute teeth or spines on the second segment of the peduncle at the base of the scale.

The oral appendages are all very nearly as in *Miersia Agassizii,* the differences being no greater in fact than might be expected between species belonging to the same genus. The labrum is nearly the same, but the lobes of the metastome are much narrower. The mandibles (Pl. XII. figs. 5, 5^a) are much the same, but the mesial edge of the ventral process is short and armed with only five or six teeth, while the anterior edge is entirely unarmed; the molar area is considerably larger, and is rounded above instead of angular; the palpus is a very little larger and the second segment proportionally a little longer. The proximal lobe of the protognath of the first maxilla (Pl. XII. fig. 6) is more angular anteriorly and its mesial edge a little longer, and the endognath has but a single spine on the fold near the tip. The protognath and endognath of the second maxilla (Pl. XII. fig. 7) are almost exactly the same, but the scaphognath is larger, more prolonged and ovate in outline at the tip, and the posterior portion projects inward less prominently. The endopod of the first maxilliped (Pl. XII. fig. 8) is much stouter and the two distal segments much more nearly equal in length, and the exopod is more expanded anteriorly and more prolonged at the outer than at the inner edge. The endopod of the second maxilliped (Pl. XI. fig. 9) is a very little stouter proximally and has a rather shorter carpus, but differs very slightly; the exopod is a very little longer; and the epipod is narrower at base, more ovate in outline, and bears a branchia composed of only a few pairs of lamellæ.

The endopods of the external maxillipeds reach considerably beyond the tips of the antennal scales, and are composed of three segments each, as in *Miersia Agassizii*, but are considerably stouter than in that species; the proximal segment is distally stouter than any part of the other segments and nearly as long as the other two together; the middle segment is scarcely more than a fourth as long as the proximal, and the distal is triquetral, tapers to an acute point, and is nearly naked but armed with a few minute spines near the tip. The exopod is multiarticulate, flagelliform, as in *Miersia Agassizii*, and about as long as the proximal segment of the endopod. The epipod is nearly as in *Miersia*.

All the thoracic legs are furnished with exopods like the external maxillipeds, and the first, second, and third pairs are furnished also with epipods as in the external maxillipeds. The legs of the first pair are not stouter than the external maxillipeds and fall considerably short of their tips: the merus is compressed and nearly as long as the proximal segment of the endopod of the external maxilliped; the carpus is scarcely half as long as the merus, subcylindrical, and slightly enlarged distally; the chela is about twice as long as the carpus, very slightly swollen proximally, and the digits nearly a third the whole length, strongly curved at the tips, and the propodal one considerably stouter at base than the dactylus. The legs of the second pair are very slender, and reach a little by the tips of the external maxillipeds: the ischium and merus are strongly compressed, and the latter is longer than in the first pair and reaches to the distal extremity of the proximal segment of the endopod of the external maxilliped; the carpus is slender, cylindrical, and about half as long as the merus; the chela is slightly longer than the carpus, scarcely as long as in the first pair, cylindrical, scarcely as stout as the carpus, not at all swollen, and with very slender and slightly compressed digits about two sevenths the entire length. The third and fourth pairs of legs are nearly alike: the ischia and meri are compressed, and nearly as in the second pair, but a little longer; the carpi are a little shorter and broader than in the second pair; the propodi and dactyli are wanting on both sides. The ischium, merus, and carpus in the posterior legs are nearly as in the third and fourth pairs, but the merus is a little shorter and narrower, while the terminal portion (Pl. XI. fig. 6) is very nearly as in *Miersia Agassizii:* the propodus is longer than the merus, nearly three times as long as the carpus, slender, nearly cylindrical, and is armed near the middle with several very long and slender setæ, toward the distal end with numerous short serrate setæ, and about the base of the dactylus with numerous long serrate, plumose and simple setæ ; the dactylus is very short and stout, scarcely as long as the diameter of the propodus, strongly curved at the tip and armed along the lower side with several spines.

The abdomen is considerably compressed, and has a sharp, but not very high, dorsal carina on the third, fourth, fifth, and sixth somites, and is prolonged posteriorly into a small tooth on the fourth and fifth somites. The outlines of the epimera are very nearly as in *Miersia Agassizii*, but the posterior margins of the third, fourth, and fifth are perhaps a little fuller and more broadly rounded. The sixth somite is scarcely once and a half as long as the fifth, and about twice as long as high.

The telson is nearly twice as long as the sixth somite, very slender distally, the dorsum is without aculei but with a broad sulcus within the broadest part of which there is a median longitudinal elevation, and the tip is armed with a pair of lateral and a pair of very slender median spines.

The outer lamella of the uropod reaches slightly by the tip of the telson, is about three times as long as broad, and with the tip rather broad and extending a little by the tooth in which the outer margin terminates, and within which there is a small spine. The inner lamella is a little shorter than the outer, about four times as long as broad, and lanceolate at tip.

The outer ramus of the appendage of the first somite is longer than the protopod and like that of the succeeding pairs, while the inner is a minute lamella about twice as long as broad. The inner rami of the four succeeding pairs of appendages are each furnished with the usual stylet for attaching together the two appendages of each pair.

There is but a single specimen in the collection, a female, wanting the left leg of the second pair and the terminal portions of both legs of the third and fourth pairs, from Station 328, N. Lat. 34° 28′ 25″, W. Long. 75° 22′ 50″, 1632 fathoms. This specimen gives the following measurements: —

Sex	♀
Length from tip of rostrum to tip of telson	75.0 mm.
" of carapax including rostrum	30.3
" of rostrum	4.5
" of antennal scale	9.5
Breadth " "	4.5
Length of sixth somite of abdomen	8.0
Height " " "	4.0
Length of telson	15.5

EUMIERSIA, gen. nov.

Resembles *Pandalus* in the external form of the carapax and abdomen, and agrees with it essentially in the structure of the oral appendages, and the two species known to me have the same number and arrangement of branchiæ and epipods as in the typical species of *Pandalus;* but the genus is more like *Miersia* in the structure of the thoracic legs, which, however, are greatly more elongated than in the species of that genus here described, and have only very small epipods at the bases of the fourth pair and none at all upon the fifth. The mandibles, though essentially as in *Pandalus*, are stouter and have larger molar processes, while the ventral processes are very thin, more expanded, and with broader serrate tips, thus approaching somewhat to the structure in *Miersia*. The mandibular palpi are much stouter than in the typical species of *Pandalus*, and have broad terminal segments.

Eumiersia ensifera, sp. nov.

Plate XIII. Figs. 1-9.

The carapax is as broad as high, with the cervical suture indicated by a distinct sulcus from the dorsum to the upper part of the hepatic region either side, where the sulcus terminates in a small but deep depression, and with a very short and inconspicuous gastro-antennal sulcus; the anterior margin is armed with a small antennal and a distinct pterygostomian spine, though the latter is wanting on one side in two of the specimens seen; back of the cervical suture the dorsum is very broad and evenly rounded, but there is usually a very small dentiform tubercle in the middle line on the posterior part of the cardiac region; the rostrum in the smaller specimens is often not more than half as long as the carapax proper, but in the larger specimens much longer and in one specimen nearly as long as the carapax, nearly straight and horizontal, or curved considerably upward as in the specimen figured, narrow, with a strong ridge either side, tapering to a more or less acute tip, and with the dorsal carina extending back upon the carapax nearly to the cervical suture and armed with twenty-five to thirty spines directed forward, movably articulated with the carapax, thickly crowded posteriorly but more and more remote anteriorly, and of which six to eight are crowded upon the carapax in about half the space between the orbit and the cervical suture; beneath, the rostrum is ciliated and in most of the specimens entirely unarmed, but in two or three cases there are one or two teeth near the tip.

The eyestalks are short and terminated by small hemispherical black eyes very nearly as in *Miersia Agassizii*. The peduncle of the antennula is about half as long as the antennal scale: the first segment is about as long as the two others taken together, excavated above for the reception of the eye, which, however, does not reach by a considerable distance the extremity of the segment, with a prominent lateral process terminating in an acute spine, and the body of the segment itself produced in a spiniform process outside the articulation with the second segment; the second and third segments are subequal in length and nearly cylindrical. The flagella are imperfect in all the specimens seen, but both were very long and slender: the upper or major flagellum is slightly compressed near the base but not suddenly expanded, and was at least as long as the carapax and apparently very much longer; the inferior flagellum was a little smaller at the base than the superior, cylindrical, and apparently about as long as the superior. The antennal scale is thick and strong, seven or eight tenths as long as the carapax excluding the rostrum, about a fourth as broad as long, only slightly narrowed toward the tip, which is truncated and does not extend beyond the strong tooth in which the thickened outer margin terminates; the second segment is armed with a small spiniform tooth below the articulation of the scale; the third segment projects scarcely beyond the second; the fourth and fifth are very short, and the fifth does not project more than its diameter in front of the second. The flagellum is wanting in all the specimens seen.

The labrum is very large, the ventral surface flattened, broader than long, and approximately rectangular, the antero-lateral angles being expanded below so as to reach nearly as far forward as the middle portion, which projects in a tuberculiform lobe a little above the plane of the ventral surface. The lobes of the metastome are broad and rather fleshy, as in *Pandalus*. The molar process of the mandible (Pl. XIII. figs. 2, 2^a) is stout, the mesial surface somewhat convex, and broken by several semicircular and concentric ridges, of which the one nearest the base of the ventral process is armed with a closely-set series of setæ. The ventral process is thin, distally broad and somewhat concave above, and armed with about eight rather slender teeth. The palpus is a little longer than the ventral process, the first and second segments subequal in length, and the third longer and much broader than the second, lamellar, and armed with numerous setæ. The proximal lobe of the protognath of the first maxilla (Fig. 3) is large, somewhat triangular, with the mesial edge two or three times as long as that of the narrow distal lobe; the endognath is much shorter than the distal lobe of the protognath and truncated at the extremity, which is armed with a stout seta either side and a third one just below the tip. The second maxilla (Fig. 4) is very nearly as in the typical species of *Pandalus*: the proximal lobe of the protognath is very much shorter than the distal, and its small anterior division is more conspicuous than in the typical species of *Pandalus*, while the two divisions of the distal lobe are nearly equal in size; the endognath is scarcely half as long as the distal lobe of the protognath; the anterior portion of the scaphognath is a little longer than the posterior, which, as in the typical species of *Pandalus*, is narrowed to an acute point, and the mesial edge furnished with exceedingly long setæ, many times longer than those upon the outer edge.

The distal lobe of the protopod of the first maxilliped (Fig. 5) is somewhat triangular in outline; the two proximal of the three segments of the endopod are subequal in length, while the distal segment is very short, but little longer than broad; the lamellar portion of the exopod reaches slightly beyond the endopod, and the flagelliform is a little longer than the lamellar portion. The ischium and merus in the second maxilliped (Fig. 6) are subequal in length; the propodus is about as long as the ischium and merus taken together, and about half as broad as long; the dactylus is articulated obliquely along the distal end of the propodus, and is five or six times as broad as long; the flagelliform exopod is slender, nearly twice as long as the endopod, and multiarticulate for half its length; the epipod bears a well-developed branchia composed of two series of numerous lamellæ. The endopods of the external maxillipeds reach nearly to the tips of the antennal scales: the proximal segment is nearly as long as the two distal, vertically compressed, with a knifelike mesial edge; the middle segment is very slender, cylindrical, and nearly naked; the distal segment is about two thirds as long as the middle, somewhat triquetral, very slightly expanded near the middle, tapered to a point distally, and armed with numerous short setæ. The exopod is very slender and about three fourths as long as the proximal segment of the endopod. The epipod is rudimentary, scarcely longer than the breadth of the protopod, in a transverse sulcus on the outer side of which it lies.

The first four pairs of thoracic legs have exopods and epipods like the external maxillipeds, but the exopods diminish in size very rapidly posteriorly, and are minute upon the fourth pair. The legs of the first pair (Fig. 7) are about as long as the carapax including the rostrum and reach to or a little by the tips of the antennal scales: the ischium is slightly longer than the merus, and both are very slender and armed with a few small spines; the carpus is very much more slender than the merus, and about twice or considerably more than twice as long, slightly enlarged at the distal extremity, and entirely naked and unarmed; the chela in the larger specimens seen is a fourth or fifth as long as the carpus, considerably stouter, slightly flattened, and the digits about a third of the entire length, slightly curved, and rather sparsely clothed with slender setæ. The second (Fig. 8) are similar to the first, but very much longer and more slender: the chela is just about as long as in the first pair, but not quite as stout, while the ischium, merus, and carpus are very much longer than in the first pair. The third, fourth, and fifth pairs of legs are more or less broken in all the specimens seen, but are very long and slender, and are all apparently longer than the second pair. The only one of these legs which is complete belongs to a female 108 mm. long, and is apparently one of the posterior pair, but is, unfortunately, detached. This leg (Fig. 9) is nearly twice as long as the first pair in the same specimen, and much more slender than the second even: the ischium and merus make a little more than half the entire length; the carpus is much longer than the merus, exceedingly slender, somewhat enlarged at the distal extremity, and entirely naked; the propodus is fully as stout as the adjacent part of the carpus, scarcely more than a tenth as long, and armed with a few short setæ on the dorsal side, a fascicle of longer setæ beneath, and a circle of very long ones about the base of the dactylus, which is slightly longer than the carpus, slender, and very slightly curved.

The first and second somites of the abdomen are broadly rounded above and not at all compressed, but the succeeding somites are considerably compressed, particularly near the dorsum, which is not really carinated on any of the somites, however, though the third somite is prolonged in a very prominent tooth over the fourth. The first epimeron is broad and evenly rounded below, the second much longer than high and elliptical, the third and fourth with the posterior edges rounded, but the fifth produced posteriorly in an acute point. The sixth somite is about twice as long as the fifth, less than half as high as long, and very strongly compressed.

The telson is about as long as the sixth somite, narrow distally, rounded above, and armed with five to ten pairs of dorsal aculei and two pairs of long spines at the tip. The outer lamella of the uropod reaches to about the tip of the telson, is nearly four times as long as broad, with the rounded tip extending much beyond the tooth in which the stout outer margin terminates and just within which there is a spine as in most species of *Pandalus*. The inner lamella is considerably shorter and much narrower than the outer, and lanceolate in outline.

In the female, the inner ramus of the appendage of the first somite of the abdomen is lamellar, about two thirds as long as the outer, four times as long as broad, and tapered to an acute point. In the male, this ramus is lamelliform, but shorter and very much broader, being ovate and about twice as long as broad. In the male the sexual appendage at the side of the stylet of the inner ramus of the appendage of the second somite is as long as the stylet, and expanded distally into a broad lamelliform and obtusely rounded tip.

The surface of the carapax and abdomen is naked, but thickly punctate.

All the specimens are imperfect and many of them fragmentary, and the accompanying measurements are consequently very incomplete.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
305	41° 33′ 15″	65° 51′ 25″	810	2 ♀ young.
308	41° 24′ 45″	65° 35′ 30″	1242	3 ♀
330	31° 41′ 0″	74° 35′ 0″	1047	2 ♂ young.
339	38° 16′ 45″	73° 10′ 30″	1186	2 ♂ small.
340	39° 25′ 30″	70° 58′ 40″	1394	2 ♀
341	39° 38′ 20″	70° 56′ 0″	1241	2 ♂

The following measurements are in millimeters: —

Station	330	339	308	340	340
Sex	♂	♂	♀	♀	♀
Length from tip of rostrum to tip of telson	44.0		108.0	122.0	125.0
“ of carapax including rostrum	15.1	25.5	42.0	48.0	51.0
Breadth of carapax	4.8	7.5	11.0	13.0	13.5
Length of rostrum	4.8	9.5	17.0	21.3	23.3
“ of antennal scale	6.8	11.3	16.2	19.0	19.5
Breadth “ “	1.5	3.0	4.4	4.7	5.0

Station	330	339	308	340	340
Sex	♂	♂	♀	♀	♀
Length of first leg	16.0	26.0	40.0		
“ ischium	3.7	6.0	9.0		
“ merus	3.3	5.8	7.8		
“ carpus	6.5	9.5	17.0		
“ chela	2.5	3.1	4.1		
“ dactylus	0.9	1.1	1.4		
“ second leg	25.0				
“ ischium	6.0				
“ merus	6.5				
“ carpus	9.0				
“ chela	2.5				
“ dactylus	0.8				
“ fifth (?) leg			77.0		
“ ischium			18.0		
“ merus			23.0		
“ carpus			28.0		
“ propodus			3.0		
“ dactylus			3.3		
“ sixth somite of abdomen	8.0		16.0	17.0	17.2
Height of “ “ “	2.7		7.0	7.3	7.5
Length of telson	6.7		15.0	18.0	17.8

PENÆIDÆ.

? BENTHESICYMUS Bate.

A single mutilated male specimen is referred very doubtfully to this genus, recently and only very imperfectly characterized by Bate. This specimen wants the larger part of the external maxillipeds, of the flagella of the antennæ and antennulæ, and of the three last pairs of thoracic legs, but the branchial formula is the same as given by Bate for his genus, and as far as the diagnosis goes the specimen agrees with it. There is nothing in the branchial formulæ given by Bate in regard to the seventh somite (the first maxillipedal), but in the specimen before me there is an epipod and a single arthrobranchia at the base of the first maxilliped. The eighth somite bears two arthrobranchiæ, a podobranchia, and an epipod ; the ninth to the twelfth inclusive bear each a pleurobranchia, two arthrobranchiæ, a podobranchia, and an epipod ; the thirteenth bears a pleurobranchia, two arthrobranchiæ, and an epipod ; and the fourteenth bears a pleurobranchia only : making in all twenty-four branchiæ and seven epipods, and of the true branchiæ six are pleuro-, thirteen arthro-, and eight podobranchiæ. The species here described has no exopods at the bases of the thoracic legs, and the maxillæ and first and second maxillipeds are much less like *Penæus* than like *Stenopus hispidus* as figured by Boas; and the species is not so closely allied to *Penæus* as might be inferred from the description of *Benthesicymus* and its place in Bate's arrangement.

Benthesicymus Bartletti, sp. nov.

Plate XIV. Figs. 1-7.

Male. — The carapax is only slightly compressed laterally, and its surface, as well as that of the abdomen, is naked and polished, but is very conspicuously and peculiarly areolated. There is only one spine each side, a prominent and acute branchiostegial, and from this a sharp carina extends back parallel with the inferior margin to near the middle of the carapax, where it is interrupted by a well-marked sulcus which, beginning as the antennal, turns slightly downward, runs back above and contiguous to the carina just described, and then turns down and nearly reaches the inferior margin; back of this carina a somewhat similar but much less conspicuous cardiaco-branchial carina accompanied by a slight sulcus extends to near the posterior margin of the carapax; there is a slight gastro-frontal sulcus at the base of the rostrum; a very deep and conspicuous transverse gastric sulcus, which slightly notches the dorsum at about the middle of the carapax, extends in an even curve downward and forward, as the gastro-hepatic, and joins the hepatic sulcus a little way back of the branchiostegial spine; and back of this sulcus there is a distinct but much less conspicuous cervical, extending from very near the middle line, at about a third of the way from the transverse gastric sulcus to the posterior margin, downward to the cardiaco-branchial suture. In front of the transverse gastric sulcus there is a sharp dorsal carina which rises into a lamellar crest and terminates in a short and laterally compressed rostrum armed above with two sharp teeth of which the posterior is slightly back of the orbit and the anterior apparently about half-way between it and the tip, which is slightly broken but appears to have terminated in an acute point about two thirds of the way from the base to the tip of the eyestalk. Both edges of the rostrum are ciliated. Back of the gastric sulcus the dorsum is broad and evenly rounded transversely.

The eyestalks (Pl. XIV. figs. 1, 1^a) are less than half as long as the antennal scales, slender, strongly compressed vertically, with a small obtuse dentiform prominence at the middle of the inner side, and just in front of and outside of this a small spot of black pigment showing faintly on the upper but conspicuously on the lower side. The eyes themselves are scarcely wider than the stalks, but are less compressed vertically, though still much broader than high, distinctly faceted, and dark brown in the alcoholic specimen.

The peduncles of the antennulæ (Figs. 1, 1^a) are more than half as long as the antennal scales, and essentially as in the species of *Penæus*. The first segment is considerably longer than the two others taken together, is expanded laterally and deeply excavated above to fit the eye, and the outer margin is armed with an acute tooth opposite the extremity of the eye and another at the distal end; the second and third segments are subequal in length and the terminal is considerably prolonged beneath at the origin of the lower flagellum; the inner and distal margins of the first segment, and nearly the whole exposed surface of the second and third, are thickly clothed with hair. The proximal part of the lower flagellum is about as stout as the flagellum of the antenna, nearly cylindrical, and naked; while the upper is considerably stouter and ciliated along the inner side.

The segments of the peduncles of the antennæ are all smooth, nearly naked, and externally unarmed, but the second segment bears, on the upper and inner edge, a slender spine curved forward and outward above the base of the scale, and there is a papilla-like prominence just above the opening of the green gland at the distal extremity of the first segment; the consolidated fourth and fifth segment is about as long as the three others taken together, is subcylindrical, and the distal segment prolonged in a thin triangular process inside the origin of the flagellum; the scale (Fig. 1^a) is about two thirds as long as the carapax, and about three times as long as broad, the greatest breadth being near the base, but the margins only slightly converging distally except near the tip, which is obliquely rounded and extends considerably beyond the acute spine in which the very slightly arcuate outer margin terminates. The proximal part of the flagellum is very slender, naked, and slightly compressed vertically.

The labrum projects far below the epistome and is broadly caudate as seen in front, but this form is perhaps a result of contraction due to preservation in alcohol. The lobes of the metastome are narrow at the base, but expand into very broad and obtuse tips.

The mandibles (Fig. 2) are almost exactly alike, and nearly as in *Penæus.* They are somewhat contracted at the crowns, which are small, with the opposing surfaces somewhat semicircular in outline and each divided longitudinally by a narrow and shallow depression into two portions, of which the ventral is obtusely triangular and obscurely bidentate, while the dorsal portion is long and narrow anteriorly, but expanded at the posterior angle into a small and somewhat oval molar area with a raised and obscurely dentate margin. The mandibular palpus is composed of two lamellar segments, of which the proximal is considerably the longer and broader, while the distal is narrowly ovate with the tip rounded; both segments are margined with soft hairs and plumose setæ.

The proximal lobe of the protognath of the first maxilla (Fig. 3) is small and ovate, the distal lobe obliquely truncated and armed as in the allied genera. The endognath is narrow, curved, unsegmented, and shorter than the distal lobe of the protognath.

The four lobes of the protognath of the second maxilla (Fig. 4) increase successively in size distally, the distal being twice as wide as the next. The endognath is much shorter than the distal lobe of the protognath, and tapers regularly to the tip. The anterior part of the scaphognath is much longer than the posterior and projects beyond the protognath, while the posterior part is short, broadly expanded, and strongly incurved at the extremity.

The protopod of the first maxilliped (Fig 5) projects anteriorly in a straight lobe twice and a half as long as broad and rounded at the tip. The endopod is composed of three very distinct segments: a narrow basal one reaching a little by the protopod and with a slight expansion of the inner edge armed with slender spines, while the rest of the inner margin and the distal part of the outer are clothed with hairs; a second segment about half as long as the first, but expanded in the middle so as to be somewhat elliptical and nearly half as broad as long, with very long plumose setæ on the outer edge and smaller and more numerous ones on the inner; and a small terminal segment about a third as long as the second, half as broad as long, and edged with small setæ or hairs. The exopod is longer even than the endopod, the proximal two-thirds or three-fourths of its length wider than the first segment of the endopod, but the distal portion rather suddenly narrowed, multiarticulate, and flagelliform. The lamelliform branchial epipod is as large as the endopod and the anterior portion a little smaller than the posterior.

The endopod of the second maxilliped (Fig. 6) is approximately uniform in breadth throughout, except the dactylus: the ischium is broader than long; the merus is about as long as the three distal segments taken together, and about three and a half times as long as broad; the carpus and propodus are subequal in length and each a little longer than wide; the dactylus is a little shorter than the propodus, only half as wide as long, and narrowed to a somewhat triangular tip, which is armed with one or more curved spines; the edges of all the segments are more or less hairy or setigerous. The exopod is slender, regularly tapered, considerably longer than the endopod, and its distal half multiarticulate, flagelliform, and furnished with long plumose setæ, while the proximal part is unsegmented and furnished with short hairs or setæ. The epipod is short, nearly orbicular, and bears a short and dense dendrobranchia.

The endopod of the external maxillipeds is unfortunately wanting. The exopod is like that of the second except that it is a little smaller; the epipod is about as long as in the second, but narrow, ovate, and bears a dendrobranchia nearly as long as itself.

The first thoracic legs are slender and reach scarcely by the bases of the antennal scales: the merus is slightly longer than the ischium, and both these segments are strongly compressed vertically and ciliated along the inner edges; the carpus is slightly compressed, about as wide as the merus, and ciliated like it; the chela is scarcely as long as the carpus, and no stouter, and the digits are about as long as the basal portion, slender, very slightly curved at the tips, and the prehensile edges ciliated.

The second legs are much like the first, but a little more slender and considerably longer, reaching to the tips of the peduncles of the antennæ; the merus and carpus are subequal in length, and the chela is considerably shorter than the carpus.

The most of the endopods of the third, fourth, and fifth pairs of legs are wanting except a detached portion of, apparently, one of the fourth pair. This fragment is longer than the carapax and consists of a slender ischium and merus, the latter twice as long as the former, a still more slender carpus nearly as long as the merus, and a portion of an exceedingly slender and filiform propodus.

The abdomen (Pl. XIV. fig. 1) to the tip of the telson is nearly twice as long as the carapax, anteriorly about as broad as high, but much compressed posteriorly, so that the sixth somite is fully twice as high as broad. The dorsum is evenly rounded on the first four somites, but there is a narrow and sharp carina on the fifth and sixth, which rises abruptly into a crest on the anterior part of the fifth. The posterior prolongations of the first and second epimera are broadly rounded ; those of the third and fourth less broad and more angular, but still obtuse and rounded at the posterior angle ; while the fifth is acutely angular, but with the tip itself obtuse. The sixth somite is twice as long as the fifth, and more than half as high as long. The telson wants the tip, but is apparently shorter than the sixth somite ; it is narrowly triangular, thickened and transversely very strongly convex above at base, but not carinated, and posteriorly flattened above.

The lamellæ of the uropods are thin and lanceolate in outline. The inner is only a little shorter than the sixth somite, less than a third as broad as long, and stiffened in the middle by two slender riblike thickenings, separated, on the dorsal surface, by a narrow sulcus. The outer is fully once and a half as long as the inner, scarcely a fourth as broad as long, and the narrow tip is prolonged far beyond the sharp spine in which the thickened outer margin terminates, and from this spine a slender riblike thickening, with a narrow sulcus along its inner edge on the dorsal surface, runs nearly parallel with the outer edge to the base of the lamella.

The abdominal appendages of the first pair are as large as those of the second, about as long as the uropods, and the distal multiarticulate portion is nearly twice as long as the protopod, slender and subcylindrical. The peculiar male appendage (petasma of Bate) is a thin, squarish plate (Pl. XIV. fig. 7) attached by a constricted base, below which there is a small oblong process (*a*) standing out at nearly right angles to the plane of the rest of the plate. The plate itself, which is apparently carried in a nearly horizontal position in front of the protopod to which it is attached, is obliquely divided vertically or longitudinally by imperfect articulations into three parts, of which the middle one is much the largest and projects at the inner inferior angle in a large ovately pointed process, while the inner or distal of the three parts is narrow and has the lower or posterior part of its free edge armed with minute hooked spines for the attachment of the appendages of the opposite sides of the animal. The outer rami of the second to the fifth pairs of abdominal appendages are similar to the single rami of the first pair, but are all considerably compressed distally. The inner ramus in the second pair is very much more slender and considerably shorter than the outer, and is furnished on the anterior side at base with two small and obtusely terminated, hard, lamelliform processes. The inner rami of the third, fourth, and fifth pairs of appendages are as in the first pair except that they are without the lamelliform process at base.

Length of carapax including rostrum	24.8+ mm.
" rostrum	3.5+
" antennal scale	17.1
Breadth of " "	5.2
Length of abdomen	53.0
" sixth somite	12.4
Height of "	7.5
Length of telson	10+
" inner lamella of uropod	11.0
Breadth of " " "	3.2
Length of outer " "	17.0
Breadth of " " "	4.0

Station 343, N. Lat. 39° 45′ 40″, W. Long. 70° 55′, 732 fathoms; one male.

AMALOPENÆUS, gen. nov.

Like the last species in general appearance, but readily distinguished from it by the second maxillipeds, in which the meri expand into broad opercular plates, and in having no podobranchiæ on any of the thoracic legs. The integument of the whole animal is membranaceous, and very soft and thin. The carapax, eyes, antennulæ, antennæ, mandibles, and maxillæ are nearly as in the species last described. The endopod of the first maxilliped is divided into three segments as in that species, but the terminal segment is larger than the penultimate, and the exopod is broad and lamelliform throughout. The merus of the second maxilliped is expanded in a thin lamelliform plate along the inside and beyond the articulation of the carpus, so that when the three distal segments are flexed they are concealed beneath it. In the external maxillipeds the ischium is longer than the merus, and both these segments are very much broader than the slender carpus and propodus, or than the short flattened and pointed dactylus. The first three pairs of thoracic legs are approximately equal and their chelæ are slender and subequal in size, but in the first pair the ischium and merus are compressed and considerably expanded. The fourth and fifth pairs of legs are about as long as the third, and very slender. There are no exopods at the bases of any of the thoracic legs. The branchiæ are arranged as in the last species except that there are no podobranchiæ at the bases of any of the thoracic legs, so that there are only twenty branchiæ and seven epipods on each side, as indicated in the following table.

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	1	1	1	1	1	0	(7)
Podobranchiæ,	0	1	0	0	0	0	0	0	1
Arthrobranchiæ,	1	2	2	2	2	2	2	0	13
Pleurobranchiæ,	0	0	1	1	1	1	1	1	6
									20+(7)

Amalopenæus elegans, sp. nov.

Plate XIV. Figs. 8-14. Plate XV. Figs. 1-5.

The carapax is not at all compressed laterally, but about as broad as high, exceedingly thin and membranaceous, and its surface naked and polished. The branchiostegial spine is very minute and the carina which extends back from it is less conspicuous than the sharp gastro-antennal and gastro-hepatic carina which is continuous posteriorly with a distinct cardiaco-branchial one; between the gastro-antennal and the branchiostegial carinæ there is a wide antennal and hepatic sulcus, which posteriorly turns down in front of the branchial region; there is a slight gastro-frontal and a very conspicuous transverse gastric and gastro-hepatic sulcus, as in the last species, while the cervical itself is equally deep and conspicuous, notches the dorsum like the gastric and only a very little way back of it, is directed downward and backward and then in a regular curve forward round the hepatic region to join the hepatic sulcus. A sharp dorsal carina extends the whole length of the carapax, but is most conspicuous in front of the gastric sulcus, rises in front into a sharp lamellar crest armed with a single sharp tooth over the posterior margin of the orbit, and projects forward in a short but acute and laterally compressed rostrum, which scarcely reaches the middle of the eyestalks.

The eyes and eyestalks are very nearly as in the last species, but the dentiform prominence is very much more prominent and conspicuous; the color of the eye and position of the pigment spot are the same, though the latter is more conspicuous above than below.

The ultimate segment of the peduncle of the antennula is much longer than the penultimate, and these two taken together are nearly as long as the first segment, but in other respects the peduncle is as in the last species. In the male the flagella are proximally subequal in diameter, but the superior is expanded somewhat along the inner side for a short distance from the base.

The antennal scale (Pl. XIV. fig. 12) is much less than half as long as the carapax, nearly three times as long as the greatest breadth, which is near the base, from where the margins arcuately converge to a narrow but obtusely rounded tip, which is scarcely in advance of the small terminal spine of the outer margin. The rest of the antennal peduncle is nearly as in the last species, and is armed with a curved spine above the base of the scale in the same way, but the terminal segment is shorter to correspond with the shorter scale. The flagellum is nearly naked, very slender, and at least much longer than the rest of the animal.

The labrum, metastome, and crowns of the mandibles are nearly as in the last species, but the labrum is full and rounded below. The mandibular palpi (Pl. XIV. fig. 9) are very large, and reach nearly to the middle of the antennal scales: the proximal segment is more than half as broad as long, nearly twice as long as the distal segment, with the distal part of the mesial edge straight and the outer edge curved and directed inward distally so as to narrow the segment very much at the articulation of the terminal segment, which is about twice and a half as long as broad, and ovate with the tip rounded.

The first maxilla is as in the last species except that the endognath (Pl. XIV. fig. 10) is expanded somewhat a little way from the base.

The proximal of the four lobes of the protognath of the second maxilla (Pl. XIV. fig. 11) is larger than the next, while the three others increase successively in size distally, though the distal is not more than a third broader than the one next it. The endognath is nearly as long as the distal lobe of the protognath, broadly expanded near the middle, where it is more than a third as broad as long and has a rounded prominence edged with slender setæ on the inner margin, but suddenly contracted to a very slender tip armed distally with four long setæ on the inner edge and with two or three stouter and curved setæ on the outer edge just below these. The scaphognath is nearly as in the last species except that the posterior part is a little narrower and not so strongly incurved.

The protopod and the branchial epipod of the first maxilliped (Pl. XV. fig. 3) are nearly as in the last species, but the endopod and exopod are very different. The proximal segment of the endopod does not reach the tip of the protopod, though it is between three and four times as long as broad, the inner edge is armed distally with three or four slender spines and the rest of the way with long setæ or hairs ; the second segment is a little narrower than the first, between a third and a half as long, about twice as long as broad, and margined with hairs ; the terminal segment is considerably wider than the second segment, and about once and a half as long, approximately elliptical, and margined all round with long setæ or hairs. The exopod is a little longer than the endopod, unsegmented, lamellar, very thin and of nearly uniform breadth throughout, rounded at the tip, and with both edges setigerous, the setæ upon the outer edge being long and plumose.

The ischium of the second maxilliped (Pl. XV. fig. 4) is very short ; the merus is considerably longer than the carpus and propodus combined, half as broad as long, and projects distally in a thin and broadly rounded lobe beyond the articulation of the carpus ; the carpus is as long as the breadth of the merus, less than half as broad as long, and somewhat narrowed proximally ; the propodus is a little shorter than the carpus, but as broad, and is slightly produced at the inner distal angle ; the dactylus is about two thirds as long as the propodus, nearly half as broad as long, obtusely pointed, and armed with a strong curved spine at the tip. The exopod is slender, reaches about to the extremity of the carpus, and is distinctly multiarticulate from near the base to the tip. The epipod is small, ovate, and bears a relatively large dendrobranchia.

The external maxillipeds (Pl. XV. fig. 5) reach nearly to the tips of the antennal scales and are longer than either the first or second pair of legs : the ischium is about a third of the entire length of the endopod, fully a third as broad as long, and very slightly narrowed proximally ; the merus is as broad and about two thirds as long as the ischium, and narrowed distally to the breadth of the carpus ; the carpus is slightly shorter than the merus, and only about a third as wide ; the propodus is very nearly as long as the carpus, but a little narrower; the dactylus itself is a little broader than the propodus, but less than half as long, broadest at the middle and with the tip triangular and armed with a slender spine not much shorter than the segment itself ; both edges of the dactylus, the extremity and inner edge of the propodus, and the inner edge of the carpus, are armed with exceedingly long and slender setiform spines, and the inner sides of the proximal segments are, as usual, armed with setæ. The exopod is slender, reaches a little beyond the ischium, and is distinctly multiarticulate to near the base. The epipod is narrow, and not longer than the breadth of the ischium.

The first and second pairs of legs (Pl. XV. figs. 1, 2) are very nearly equal in length, the first pair reaching about to the extremities of the peduncles of the antennæ, and the second pair scarcely falling short of the same point. In both pairs the corresponding segments are of very nearly equal lengths, except the carpi which are a very little longer in the second pair, but the ischia, meri, and carpi are narrower in the second than in the first : the ischium is about two thirds as long as the merus, half as broad as long in the first pair, and scarcely more than a third as broad as long in the second ; the merus is nearly a third of the entire length of the endopod, slightly narrowed distally, and in the first pair more than a third as broad as long, but in the second pair scarcely more than a fifth as broad as long ; the carpus in the first pair is about two thirds as long and half as wide as the merus, while in the second pair it is absolutely a little narrower than in the first ; the chelæ are very nearly alike in both pairs, about as long and broad as the carpus in the second pair, with the fingers slender, curved at the tips, and scarcely more than two thirds as long as the basal portion ; the edges of the chelæ are furnished with fascicles of short setæ, the tips of the fingers densely clothed with much longer setæ and hairs, the inner edges of the other segments thickly clothed with plumose hairs and long setæ, and the outer edges sparsely clothed with short hairs, except on the carpus in the second pair where the outer edge is thickly hairy. The legs of the third pair are considerably longer and much more slender than those of the second, beyond which they reach by the length of their chelæ ; the ischium is about as long as.in the second pair, but narrower ; the merus is twice as long as the carpus, very slender, and of nearly equal diameter throughout ; the carpus is a little shorter and scarcely stouter than the merus, and very slightly thickened distally ; the chela is very near the same size as in the first and second pairs, but the fingers are apparently a little longer in proportion.

The third and fourth pairs of legs are nearly alike, a little longer than the third pair and very slender, the fifth being a little more slender than the fourth, and both sparsely armed with long setiform spines, except upon the dactyli, which are nearly naked, long, very slightly curved, and acute.

The abdomen to the tip of the telson is about twice as long as the carapax, anteriorly about as broad as the carapax and with the dorsum broadly rounded, but much compressed posteriorly, so that the sixth somite is twice as high as broad. None of the anterior somites are dorsally carinated or toothed, but the sixth, which is nearly twice as long as the fifth and half as high as long, has a thin dorsal carina nearly the whole length. The epimera of all somites are rather small, and the posterior angle is more or less rounded in all.

The telson is about two thirds as long as the sixth somite, narrowly triangular, thickened at base, with a longitudinal sulcus the whole length above and with a shorter one either side near the base, and with the tip truncated, narrow, and armed with a spine either side and a series of long plumose hairs between.

The inner lamella of the uropod is a little longer than the sixth somite, lanceolate, and about six times as long as broad. The outer lamella is about a fifth longer than the inner, scarcely wider proportionally, and with the ovate tip prolonged far beyond the sharp spine in which the outer margin terminates.

In both sexes the protopods of the appendages of the first to the fifth somite are stout and all nearly alike, the outer rami are all very long and slender, and the inner rami of the four posterior pairs are shorter and more slender than the outer. The peculiar sexual appendage of the first pair of appendages in the male is carried as in the last species, and, as in that species, consists of a thin, squarish plate (Pl. XIV. figs. 13, 14) divided by imperfect articulations into three parts and attached by a constricted base, below which there is a small, broad, oval process (*a*) ; but the middle of the three parts is as large as the two others combined, inferiorly projects beyond the other parts, and at either side there is an obtuse tooth, above the outer of which there is an obtuse lobe in the margin and then a deep and narrow notch separating the middle from the inner or distal part, while above the notch on the anterior side there is an oblong process (*b*) which may be turned either in over the distal part of the plate or out over the middle part ; the distal part is thin, membranous, curls easily over upon the middle part, and is armed along the free edge with minute hooked spines as in the last species. There are two small, lamelliform plates at the base of the inner ramus in the second pair of appendages of the male, as in the last species.

All the specimens are more or less imperfect, and most of them in very bad condition on account of the softness of the integument and the exceeding fragility of the appendages, so that it is nearly impossible to present a general figure of the whole animal or give accurate measurements. Three specimens, however, give the following approximate measurements in millimeters : —

Station	330	328	893
Sex	♂	♀	♀
Length of carapax including rostrum	9.7	13.5	12.5
" antennal scale		6.4	6.8
Breadth of " "		2.5	2.7
Length of abdomen	20.0	27.0	27.0
" sixth somite of abdomen	5.0	6.2	6.7
Height of " " "	2.5	3.5	3.2
Length of telson			5.0

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
323	33° 19′ 0″	76° 12′ 30″	457	2 ♀, fragmentary.
324	33° 27′ 20″	75° 53′ 30″	1386	1 ♂
325	33° 35′ 20″	76° 0′ 0″	647	1 ♀, fragmentary.
328	34° 28′ 25″	75° 22′ 50″	1632	2 ♀, 1 fragmentary.
330	31° 41′ 0″	74° 35′ 0″	1047	2 ♂
343	39° 45′ 40″	70° 55′ 0″	732	Fragments only.

From Station 325, there is the crushed and fragmentary cephalothoracic portion of another specimen, apparently of this species, but having two teeth on the crest of the rostrum, the second tooth being about half-way between the one above the posterior margin of the orbit and the tip of the rostrum.

This species has also been taken by the U. S. Fish Commission at the following stations off Block Island, in 1880 and 1881 : —

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
893	39° 52′ 20″	70° 58′ 0″	372	1 ♀
935	39° 45′ 0″	69° 44′ 45″	770	1 ♂
952	39° 55′ 0″	70° 28′ 0″	388	1 ♂

Among these were the only specimens which had either of the fourth and fifth pairs of legs, the telson, or the uropodal lamellæ perfect.

The specimens in alcohol retain for a considerable time bright purple markings about the oral appendages, and give out a peculiar, bright red, oil-like fluid, after the manner of the species of *Sergestes* and some of the deep-water Schizopoda.

Hymenopenæus debilis, gen. et sp. nov.

Plate XV. Figs. 6-11. Plate XVI. Figs. 1-3.

The whole integument is membranaceous and exceedingly thin and soft. The carapax is smooth, naked, slightly compressed laterally, and dorsally carinated the whole length but not conspicuously on the posterior part ; there are four large and acute lateral spines either side, — an antennal, an hepatic, one a little way back of the antennal, and another (branchiostegial ?) below and in front of the hepatic and near the lower edge of the carapax ; the gastro-hepatic sulcus is conspicuous and deep, and continues upward to the dorsal line considerably back of the middle of the carapax and terminates below in front of the hepatic spine in a depression from which a narrow sulcus extends backward and divides, sending a short branch downward in front of the branchial region and a long one back to become the cardiaco-branchial. The rostrum is nearly straight, a little less than half as long as the rest of the carapax along the dorsum, compressed but not high, terminates in an acute point, is armed above with six or seven teeth besides three more widely separated and nearly equidistant ones upon the anterior half of the carapax proper, and near the tip below with a closely set series of hairs.

The eyes are large, reniform, and black, as in the typical species of *Penæus*.

The peduncle of the antennula is much longer than the rostrum: the first segment is more than half the entire length, excavated above for the reception of the eye, but the lamelliform appendage is small, narrow, and concealed between the eyestalks; the second segment is about half as long as the first, and somewhat triquetral; the body of the ultimate segment is not quite half as long as the second, but is prolonged in a narrow process beneath the bases of the flagella; the upper flagellum is slender, cylindrical and longer than the carapax and rostrum; the proximal portion of the lower flagellum is slender and cylindrical, like the upper, but the terminal portion is wanting in all the specimens seen.

The antennal scale is about half as long as the carapax including the rostrum, nearly four times as long as broad, and contracted distally to a rather narrow but evenly rounded tip, which projects scarcely beyond the terminal spine of the outer margin. The second segment of the peduncle of the antenna is armed with a slender spine just outside the articulation of the scale, and the consolidated fourth and fifth segments reach nearly to the middle of the scale and are subcylindrical. The flagellum is slender, cylindrical, and three or more times as long as the rest of the animal.

The labrum, metastome, and crowns of the mandibles are nearly as in *Penæus*. The mandibular palpi (Pl. XVI. fig. 1) are very much as in the *Amalopenæus* just described, and reach to about the middle of the antennal scales: the proximal segment is about half as broad as long and once and two thirds as long as the distal segment, which is three times as long as broad, and ovate with the tip obtuse.

The proximal lobe of the first maxilla (Pl. XVI. fig. 2) is large, broadly rounded at the extremity, and armed with very long setiform spines and setæ; the distal lobe is broad and truncated at the extremity, and armed with slender spines and setæ rather shorter than on the proximal lobe; the endognath is shorter than the distal lobe of the protognath, has a slight expansion margined with hairs on the outer edge near the base, and tapers to an obtuse tip (Fig. 2^a) armed on the inner edge with three very long and distally plumose setæ, and on the anterior surface with very delicate hairs.

The second maxilla (Pl. XVI. fig. 3) is very much as in many species of *Penæus*. The three proximal lobes of the protognath are subequal and narrow, and the distal lobe about twice as wide as they, but still rather narrow and ovate. The endognath is much shorter than the distal lobe of the protognath, and terminates in a narrow thickened fold (Fig. 3^a) on the posterior side armed along either edge and on the anterior side with a longitudinal series of slender spines or spiniform setæ, of which the distal one on the inner edge, the anterior series, and the distal ones of the outer series are very long. The anterior lobe of the scaphognath is long and very narrow, and projects considerably beyond the protognath, while the posterior lobe is large, broad, and curved strongly inward and anteriorly as in the allied genera.

The first maxillipeds (Pl. XV. fig. 7) resemble those of the typical species of *Penæus*. The distal lobe of the protopod is large, rounded in outline distally and about two and a half times as long as broad. The endopod is composed of three segments : the proximal segment is a little more than half the whole length, broad at base but narrow distally and with the inner margin abruptly contracted near the middle, leaving an angular projection which is armed with long setæ, while beyond this projection it is narrowed to near the extremity and is regularly curved inward round, and extends considerably beyond, the end of the protopod ; the two distal segments are nearly straight, approximately equal in length, very narrow, and with a regular series of slender plumose setæ along either edge, those on the outer edge being much the larger. The exopod reaches to about the base of the distal segment of the endopod, is narrow, twelve to fifteen times as long as broad, but lamellar, and edged with a regular series of long plumose setæ. The epipod is small, but with a distinct anterior lobe, has a few hairs or setæ along the edges, and is apparently not branchial.

The endopod in the second maxilliped (Pl. XV. fig. 8) is large and stout : the ischium as usual is shorter than broad ; the merus is as long as the entire protognath of the first maxilliped, and about a fourth as broad as long ; the three distal segments are subequal in length and together about as long as the merus, the propodus about as wide as the merus, but the carpus and dactylus a little narrower ; the dactylus is obtusely rounded and armed with a few strong spines distally, and both margins of the three distal segments and the inner margins of the proximal are clothed as usual with stout setæ and hairs. The exopod is very small, slender, nearly cylindrical, about as long as the merus, and the distal half multiarticulate, flagelliform, and furnished with small plumose setæ. The lamellar epipod is narrow-ovate, not bilobed distally, and bears a rather small dendrobranchia.

The external maxillipeds (Pl. XV. fig. 9) are very long and slender, though as thick as any of the legs, longer than the carapax and rostrum, and reach beyond the tips of the antennal scales fully the length of their dactyli: the ischium, merus, and carpus are approximately equal in length and subequal in diameter ; the propodus and dactylus taper slightly and regularly ; the propodus is fully two thirds and the dactylus half as long as the carpus ; all the segments are thickly armed along the inner side with fascicles of exceedingly long and slender spines or stout setæ, and the three distal are similarly armed, but with shorter spines and setæ, on the other sides. The exopod is rudimentary and exceedingly minute, being very slender and much shorter than the diameter of the merus. The epipod is well developed, lanceolate, and undivided at the tip.

All the thoracic legs have very minute exopods, and all except the fifth pair have narrow and undivided epipods like the external maxillipeds. The first legs (Pl. XV. fig. 10) are about as long as the carapax excluding the rostrum, reach to the middle of the antennal scales, are slightly compressed, and stouter than the succeeding pairs : the merus is about twice as long as the ischium and seven or eight times as long as broad; the carpus is a third or fourth shorter than the ischium, but as broad; the chela is slightly stouter than the carpus and only a little shorter, and has slightly curved digits about two thirds of the whole length; the lower edges of the ischium, merus, and carpus are armed with fascicles of long spines and setæ as in the external maxillipeds, the upper edges of these segments and both edges of the chela are armed with much smaller spines or setæ, and in addition there is a small area densely covered with very short setæ or hairs near the distal end of the lower edge of the carpus, and a similar area in a corresponding position at the proximal end of the chela. The second legs are a half longer and much more slender than the first, nearly cylindrical, reach to the tips of the antennal scales, and are almost entirely naked. The third legs (Pl. XV. fig. 11) are like the second, but longer, reaching to the tips of the external maxillipeds. The chelæ of the second and third pairs are about as long as those of the first, but more slender, with proportionally shorter, straight and weak digits, and naked except for a few very minute hairs near the tips of the digits.

The fourth and fifth pairs of legs are exceedingly long and slender, and apparently very nearly alike, but the distal segments are wanting in all the specimens seen; the meri, however, reach to about the tips of the antennal scales in both pairs, but in the fifth pair a little farther than in the fourth; and the parts which are preserved are almost entirely unarmed.

The branchiæ appear to be less densely branched than in the typical species of *Penæus*, and there are two arthrobranchiæ at the base of the penultimate leg each side instead of one, making nineteen branchiæ on each side arranged as indicated in the following table.

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	1	1	1	1	1	0	(7)
Podobranchiæ,	0	1	0	0	0	0	0	0	1
Arthrobranchiæ,		2	2	2	2	2	2	0	12
Pleurobranchiæ,	0	0	1	1	1	1	1	1	6
									19+(7)

The abdomen to the tip of the telson is slightly more than once and a half as long as the carapax including the rostrum, anteriorly nearly as broad as the carapax, but strongly compressed back of the third somite so that the sixth somite, which is nearly a fourth of the entire length of the abdomen and nearly twice as long as high, is nearly twice as high as broad. The three anterior somites are evenly rounded above, but the three posterior are sharply carinated, and on the fifth and sixth somites the carina terminates at the posterior margin in a small tooth. The epimera of all the somites are rather small, and have the posterior angles more or less rounded.

The telson is not quite perfect at the tip in any of the specimens, but is nearly three fourths as long as the sixth somite, narrowly triangular, thickened at base, has shallow dorsal and lateral sulci nearly the whole length, and the lower edge each side is armed near the tip, with a slender spine.

The inner lamella of the uropod is slightly longer than the sixth somite, lanceolate, and about four times as long as broad. The outer lamella is just about as long and wide as the antennal scale, but is broader at the tip.

There are only three specimens in the collection, all apparently females, and all more or less imperfect. The largest specimen, from Station 323, gives the following measurements, which, on account of the soft condition of the specimen, are more or less approximate.

Length from tip of rostrum to tip of telson	42.0 mm.
Length of carapax including rostrum	16.3
" rostrum	5.5
" antennal scale	8.0
" external maxilliped	19.0
" first pair of legs	12.0
" second pair of legs	18.0
" third pair of legs	22.0
" sixth somite of abdomen	6.2
Height of " " "	3.3
Length of inner lamella of uropod	6.5
Breadth " " "	1.6
Length of outer lamella of uropod	8.2
Breadth " " "	2.0

Possibly none of the specimens are fully grown, but all have apparently attained the characters of the adult. The smallest specimen, less than 30 mm. in length, does not differ, except in size, from the largest.

Station.	N. Lat.	W. Long.	Fathoms.
317	31° 57′ 0″	78° 18′ 35″	333
323	33° 19′ 0″	76° 12′ 30″	457
326	33° 42′ 15″	76° 0′ 50″	464

The genus *Penœus*, even after the subdivisions recently made by Bate, includes species differing widely in the structure of the articular appendages and in the arrangement of the branchiæ, but the genus here proposed appears to differ from all these species in the small and narrow terminal segment of the mandibular palpus, the rudimentary character of the exopods of the external maxillipeds and legs, the number and arrangement of the branchiæ, and the membranaceous character of the integument. From the typical species of *Penœus* it differs moreover in the short and unsegmented endognath of the first maxilla and in the sulcation and armament of the carapax. The species here described is possibly closely allied to, or even congeneric with, *Haliporus* Bate, which, however, is so imperfectly characterized, and the four species referred to it so briefly described, that it is impossible to determine its affinities with any certainty.

SERGESTIDÆ.

Sergestes arcticus Kröyer.

Oversigt Vidensk. Selsk. Forhandl. Kjöbenhaven, 1855, p. (6) ; Monograph. Sergestes, Vidensk. Selsk. Skr., V., Naturvidensk. mathem. Afh., IV. pp. 240, 276, Pl. III. figs. *7a – 7g*, Pl. V. fig. 16, 1856.

Smith, Proc. National Mus., Washington, III. p. 445, 1881.

Plate XVI. Fig. 4.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
304	41° 35′ 0″	65° 57′ 30″	139	Fragments only.
309	40° 11′ 40″	68° 22′ 0″	304	1 ♀
326	33° 42′ 15″	76° 0′ 50″	464	1 ♂, 1 ♀
337	38° 20′ 8″	73° 23′ 20″	740	1 ♀, 55 mm. in length.

In this species there is an epipod and a well-developed podobranchia at the base of the second maxilliped, and above its base a simple lamella in place of a pleurobranchia, a large anterior pleurobranchia with a simple lamella back of it on each of the three succeeding somites, a large anterior and a small posterior pleurobranchia on the antepenultimate somite, and on the penultimate somite two small branchiæ, of which the posterior is very much the smaller, while the last somite is without branchiæ; or, indicating the simple pleurolamellæ by accents, the branchial formula* may be indicated as follows : —

Somites.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Total.
Epipods,	1	1	0	0	0	0	0	0	(2)
Podobranchiæ,	0	1	0	0	0	0	0	0	1
Arthrobranchiæ,	0	0	0	0	0	0	0	0	0
Pleurobranchiæ,	0	0′	1′	1′	1′	2	2	0	7
									8+(2)

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* Boas (Studier over Decapodernes Stægtskabsforhold, Vidensk. Selsk. Skr., VI., Natuvidensk. mathem. Afh., I., 1880), for *S. Frisii* Kröyer, gives an epipod and a rudimentary *arthrobranchia* for the eighth somite and a single pleurobranchia for each of the succeeding somites *including the last.* Bate (Ann. Mag. Nat. Hist., 5th ser., VIII. p. 193, 1881), gives, for the genus *Sergestes*, a "mastibranchia" (epipod) and one *pleurobranchia* for the eighth somite, a single pleurobranchia for the ninth, a pleurobranchia and pleurolamella each for the tenth, eleventh, and twelfth, two pleurobranchiæ for the thirteenth, and nothing for the last ; but under *S. Kröyeri* he says, "This species has two well-developed pleurobranchiæ attached to the penultimate somite of the pereion, two to the antepenultimate, one plume and a leaflike plate to the next three somites, and one plume and a rudimentary mastibranchial plate to the first pair of gnathopoda" (second maxillipeds). This last statement of Bate would apparently indicate an arrangement of the branchiæ much like that which I have given above, or even nearer to that of *S. robustus* described beyond, but it is very unlike the arrangement indicated by his formula for the genus.

The structure of the branchiæ themselves, in this and in the two following species as well, is very different from that in *Penæus*, or any of the Penæidæ described in this paper. The branchiæ are pinnate in form, and each pinna is a complete phyllobranchia; that is, they are compound phyllobranchiæ, while those of *Penæus* are compound trichobranchiæ. The structure is more like that in *Sicyonia* (judging by Bate's description of the branchiæ of that genus) than that in *Penæus.*

The first pair of thoracic legs are subchelate, and the dactyli of the external maxillipeds and the propodi of the first, second, and third pairs of legs are multiarticulate, as in the next species, the articulations being more conspicuous than in that species. These structural characters of the thoracic legs are, however, undoubtedly characteristic of all the species of the genus.

{Sergestes robustus, sp. nov.

Plate XVI. Figs. 5-8^b.

Male. — The carapax is strongly compressed, the breadth being considerably more than the height at the base of the antennæ, but much less than the greatest height posteriorly, which is rather more than twice that at the base of the antennæ. The dorsum is broadly rounded to the base of the rostrum, which rises rather abruptly from the dorsum, is very thin, acutely triangular, and extends a little forward of the truncated middle lobe of the ophthalmic somite.

The eyestalks to the tips of the eyes are about two fifths as long as the antennal scales, and the diameter of the eye itself about half the length. The peduncle of the antennula is about a fifth longer than the antennal scale, the first segment scarcely half as long as the antennal scale, and the second and third successively a little shorter; all the segments are very stout, the diameter in the second and third being equal to more than half the length. The proximal segment of the upper or major flagellum is scarcely more than a fourth as long as the distal segment of the peduncle, and scarcely longer than the proximal segment of the lower flagellum, which is modified as in the allied species. The antennal scale (Fig. 7) is about half as long as the carapax along the dorsal line, about a third as broad as long, and much broader at the tip than in the allied species.

The oral appendages do not differ essentially from the oral appendages of *P. Frisii* and *arcticus* as figured by Kröyer.

The external maxillipeds reach by the tips of the antennal scales fully the length of their dactyli, and are about as stout as the third pair of legs: all five segments of the endopod are approximately equal in length though the dactylus is slightly shorter than the others, and all are armed with very slender spines; the dactylus is slender and multiarticulate, being composed of about five segments, and tipped with two or three spines. The legs of the first pair fall a little short of the tips of the antennal scales: the merus is about twice as long as the carpus and about as long as the propodus, which is very slender, composed of about ten segments, and armed, like the ischium, merus, and carpus, with exceedingly long, and for the most part simple, setiform spines, and at the proximal extremity with a tuft of serrate setæ corresponding to a similar tuft on the distal extremity of the propodus; the dactylus is very minute, but perfectly distinct, and armed with an exceedingly long and slender spiniform seta, while the tip of the propodus is armed with a very much shorter spine. The legs of the second pair reach to about the tips of the external maxillipeds: the merus is a little longer than in the first pair; the carpus twice as long as in the first pair and only a little shorter than the merus; the propodus is longer than the merus, composed of about twelve segments, and armed very nearly as in the first pair, except that the tuft of setæ at the proximal extremity, with the corresponding one on the carpus, is wholly wanting, while the digits of the well-developed chela (Fig. 6) are considerably longer than the diameter of the propodus at their base, slender, nearly straight, and armed at the tips with a dense brush of setæ, most of which are serrate. The legs of the third pair are almost exactly like those of the second, except that they are considerably longer, reaching by the second pair by about half the length of their dactyli. The legs of the fourth pair reach nearly to the tips of the carpi of the third pair and are very much stouter, and the endopods are composed of only four segments each, the dactylus, apparently, being wanting: the ischium, carpus, and propodus (or the proximal and the two distal segments) are subequal in length, while the merus (or antepenultimate segment) is about once and a half as long as each of the others: the merus is about six times as long as broad, and, like the ischium, densely ciliated along both edges, but the cilia on the lower edge are several times longer than those upon the upper, which are not as long as the breadth of the segment; the carpus is slightly broader than the merus, being more than a fourth as broad as long, ciliated like the merus along the lower edge, but the upper edge naked; the propodus (or ultimate segment) is a little less than a fifth as broad as long, ovate at the tip, and has the lower edge ciliated and the upper naked like the carpus. The legs of the fifth pair are a little more than half as long as those of the fourth, and their endopods are composed of the same number of segments: the ischium and carpus are subequal in length, the merus a little longer, and propodus a little shorter, and all the segments are ciliated along both edges, though the cilia upon the lower edge are much longer than those upon the upper; the merus is about a fourth as broad as long, and considerably broader than the ischium or carpus; the carpus is less than a fourth as broad as long, and slightly tapered distally; the propodus is a little less than a fifth as broad as long, and regularly tapered from near the base to the acute tip.

The abdomen, excluding the telson, is nearly twice as long as the carapax along the dorsal line, is considerably compressed, though anteriorly about as broad as the carapax, and, like the carapax, rounded above, but with a shallow median sulcus on each of the first four somites, inconspicuous on the first and second, but distinct on the third and fourth. [There are similar sulci on the abdomen of *S. arcticus*, and they are possibly, though apparently not, due to contraction from preservation in strong alcohol.] The epimera of the first three somites are large and project backward in an angle, while the epimera of the fourth and fifth somites project backward quite as far, but have the outline more rounded. The sixth somite is about as long as the antennal scale, considerably more than half as high as long, and strongly compressed.

The telson is considerably shorter than the sixth somite, flattened and slightly sulcated above, with a deep lateral groove each side, acutely angular at the tip, and ciliated along the edges. The inner lamella of the uropod is a little longer than the telson, about three and a half times as long as broad, and lanceolate at the tip. The outer lamella is between a third and a fourth longer than the inner, less than a fourth as broad as long, the outer margin terminating in a strong tooth about two thirds of the way from the base to the tip, and the tip narrow, but rounded.

The peculiar sexual appendages (petasma, Fig. 8) of the first somite of the abdomen have essentially the same structure as in *S. arcticus*, but are much more complicated than would be inferred from the figures for that species given by Kröyer. The appendages of the two sides are usually hooked together along the middle line (*h*), but are really entirely distinct. Each is attached by a narrow process (*a*) to the protopod of the abdominal appendage, and is divided by more or less distinct sutures into three portions. The outer portion, that next the protopod, projects above the point of attachment in a narrow process, and below the point of attachment in a broad lamellar lateral expansion, and below this in a long, flat, chitinous stylet (*b*) terminating in a sharp hook below a rounded sinus in the extremity. The middle portion projects below and alongside of, but far beyond, the hooked stylet (*b*), in a complicated appendage divided distally into three membranaceous and hook-bearing processes (*e*, *f*, *g*) and bearing two slender and unarmed stylets (*c*, *d*) ; and each of the membranaceous processes is armed along one edge with a series of peculiar chitinous hooks retracted within invaginated papillæ (Fig. 8^b), and at the tip with a larger and somewhat differently shaped but similarly retracted hook (Fig. 8^a). The lateral hooks themselves are semi-mushroom-shaped, like those which serve to hook together the inner rami of the abdominal appendages in many crustaceans, and very much like those along the mesial edge (*h*) of this same appendage, but larger. The terminal hooks are more properly hook-shaped, as shown in the figure, but are broad at the tips. The invagination of the membrane around the hooks is possibly due to contraction in the alcoholic specimens, but the hooks are similarly retracted in all the specimens of *S. arcticus* which I have examined, their bases appear to be connected with strong muscular fibres, and I think there is little doubt that the hooks are capable of being retracted in life. The mesial portion of appendages is thin, lamellar, longitudinally folded, and armed along the mesial edge with great numbers of semi-mushroom-shaped hooks which serve to attach together the appendages of the two sides.

The branchiæ are the same in number and have the same arrangement as in *S. arcticus*, but the posterior branchia on the twelfth (antepenultimate) somite is nearly as large as the anterior, which is the largest of the series, and the branchiæ of the penultimate segment are very nearly alike, and not very much smaller than the pair next in front of them.

I have seen only four specimens, all males, and but one of these is in the "Blake" collection; this one from Station 328, N. Lat. 34° 28′ 25″, W. Long. 75° 22′ 50″, 1632 fathoms. The other specimens are from the collections made by the U. S. Fish Commission off Martha's Vineyard: Stations 893 and 952, 372 and 388 fathoms.

Two specimens give the following measurements: —

Station	893	328
Sex	♂	♂
Length from tip of rostrum to tip of telson	58.0 mm.	65.0 mm.
" of carapax along dorsal line	17.8	19.5
" of rostrum	1.2	1.3
Height of carapax anteriorly	4.0	4.5
" " posteriorly	8.5	9.5
Breadth of carapax	5.6	6.3
Length of eyestalk and eye	3.5	3.9
Diameter of eye	1.7	1.9
Length of antennal scale	9.0	9.2
Breadth of antennal scale	2.9	1.3
Length of sixth somite of abdomen	9.0	10.0
" telson	7.5	8.0
" inner lamella of uropod	8.0	8.3
" outer " "	11.0	12.0

This is the species which I have referred to as "Sergestes sp." in Proc. National Mus., Washington, III. p. 445, 1881.

Sergestes, sp. indet.

There are specimens of a third species of *Sergestes* from Station 328, N. Lat. 34° 28′ 25″, W. Long. 75° 22′ 55″, 1632 fathoms, and fragments of apparently the same species from Station 325, N. Lat. 33° 35′ 20″, W. Long. 76°, 647 fathoms. These specimens are all in bad condition and want a large part of the appendages, but they are interesting on account of the modification of the branchial formula. The branchiæ are all much smaller than in *S. robustus*, the posterior pleurobranchia of the twelfth (antepenultimate) somite is replaced by a simple lamella like that upon the somite next in front, and the two branchiæ of the penultimate somite are very small, as in *S. arcticus*. The species is apparently even larger than *S. robustus*, and much like it in general appearance, but the rostrum is much smaller and apparently obtuse, and the eyes are very small, scarcely larger than eyestalks. The specimens are all females.

EXPLANATION OF THE PLATES.

All the figures on Plates I., III., and V.; Figs. 1 to 4^b, 5, Plate II.; Fig. 1, Plate IV.; Figs. 1, 2, 3, Plate VI.; Figs. 1, 1^a, 1^b, 2, 2^a, 4, 4^a, 5, 5^a, Plate VII.; Figs. 1, 1^a, 1^b, 2, Plate VIII.; Figs. 1, 2, 2^a, Plate IX.; Figs. 1, 2, Plate X.; Figs. 4, 5, 8, Plate XI.; Fig. 1, Plate XIII.; and Fig. 5, Plate XVI., were drawn by J. H. Emerton. All the other figures were drawn by the author.

PLATE I.

Fig. 1. *Lithodes Agassizii.* Dorsal view of female from Station 329, half natural size.

" 2. Dorsal view of a young specimen taken off Martha's Vineyard by the U. S. Fish Commission, Station 1029, enlarged two diameters.

" 2^a. Lateral view of the carapax of the same specimen, enlarged two diameters.

PLATE II.

Fig. 1. *Cyclodorippe nitida* A. Milne-Edwards. Dorsal view of female, enlarged two diameters.

" 1^a. Front view of same specimen, enlarged four diameters.

" 1^b. Ventral view of same specimen, the distal portions of the legs omitted, enlarged four diameters.

" 2. *Amathia Agassizii.* Dorsal view of the carapax of the male from Station 319, natural size.

" 3. Dorsal view of a young specimen from Station 317, enlarged two diameters.

" 4. *Parapagurus pilosimanus* Smith. Lateral view of the left side of the originally described male specimen, taken on a trawl line, off Nova Scotia, half natural size.

" 4^a. Dorsal view of the chelipeds of the same specimen, half natural size.

" 4^b. Dorsal view of the carapax and anterior appendages of the same specimen, natural size.

" 4^c. Appendage of the right side of the first somite of the abdomen of the same specimen, seen from behind, enlarged four diameters.

" 4^d. Appendage of the right side of the second somite of the abdomen of the same specimen, seen from behind, enlarged four diameters.

" 5. *Eupagurus politus.* Lateral view of left side of male, dredged by the U. S. Fish Commission off Martha's Vineyard, Station 922, natural size.

PLATE III.

Fig. 1. *Pentacheles sculptus* Smith. Dorsal view of female, from Station 326, natural size.

PLATE IV.

Fig. 1. *Pentacheles sculptus* Smith. Ventral view of the cephalo-thorax of the specimen figured on the last plate, the distal portions of the appendages omitted, natural size; *a*, tubular process containing the canal of the green gland; *b*, process of the ophthalmic lobe.

" 2. Mandible and lobe of metastome of the right side, as seen in place from below, from the male from Station 326, enlarged about two diameters.

" 2^a^. Palpus of the same mandible, seen from below, enlarged about two diameters.

" 3. First maxilla of the right side of the same specimen, seen from below, enlarged about two diameters.

" 4. Second maxilla of the right side of the same specimen, seen from below, enlarged about two diameters.

" 5. Diagrammatic outline of the anterior portion of the first maxilliped of the right side of the same specimen, as seen in place from below, enlarged about two diameters; *a*, proximal, and *a′*, distal lobe of the protopod; *b*, base of endopod, the terminal portion being entirely hidden by the exopod; *c*, basal portion of the exopod; *d*, *e*, terminal lobes of the exopod.

" 5^a. The same maxilliped removed from the animal, slightly compressed and seen from a little one side and below, enlarged about two diameters; *a*, *a′*, *b*, *c*, *d*, same as in last figure; *f*, *g*, epipodal lamella.

" 5^b. Terminal portion of the same maxilliped, seen from above under slight pressure, enlarged about two diameters; lettering the same as in figures 5, 5^a.

" 6. Second maxilliped of the right side of the same specimen, enlarged about two diameters.

" 7. External maxilliped of the right side of the same specimen, enlarged two diameters; *a*, rudimentary epipod.

" 8. Chela of the right great cheliped of the female figured on Plate III., natural size.

" 9. Chela of the right leg of the second pair of the male from Station 326, enlarged about two diameters.

" 10. Rudimentary chela of the right leg of the third pair of the same specimen, enlarged about two diameters.

" 11. Rudimentary chela of the right leg of the fifth pair of the same specimen, enlarged about two diameters.

" 12. Rudimentary chela of the right leg of the fifth pair of the female from Station 898, U. S. Fish Commission, enlarged about two diameters.

" 13. Appendage of the left side of the first somite of the abdomen of the female figured on Plate III., enlarged about two diameters.

" 14. Appendage of the left side of the first somite of the male from Station 326, enlarged about two diameters.

PLATE V.

Fig. 1. *Rhachocaris longirostra.* Lateral view of female from Station 330, enlarged two diameters.

" 2. *Rhachocaris Agassizii.* Lateral view of female from Station 326, natural size.

" 3. *Rhachocaris sculpta.* Lateral view of female from Station 339, natural size.

PLATE VI.

Fig. 1. *Rhachocaris longirostra.* Dorsal view of carapax and anterior appendages of the specimen figured on Plate V., enlarged two diameters.

" 2. *Rhachocaris Agassizii.* Dorsal view of the specimen figured on Plate V., natural size.

" 3. *Rhachocaris sculpta.* Dorsal view of the specimen figured on Plate V., natural size.

" 3^a. First maxilla of the right side of the same specimen enlarged six diameters.

" 3^b. Second maxilla of the right side of the same specimen, enlarged four diameters.

" 3^c. First maxilliped of the right side of the same specimen, enlarged six diameters.

" 3^d. Second maxilliped of the right side of the same specimen, enlarged four diameters.

PLATE VII.

Fig. 1. *Pontophilus brevirostris* Smith. Dorsal view of adult female, enlarged two diameters.

" 1^a. Lateral view of the carapax of the same specimen, enlarged two diameters.

" 1^b. Dorsal view of rostrum of the same specimen, enlarged eight diameters.

" 2. *Pontophilus gracilis.* Dorsal view of female, enlarged two diameters.

" 2^a. Lateral view of the carapax of the same specimen, enlarged two diameters.

" 2^b. Appendage of the left side of the first somite of the abdomen of the same specimen, enlarged eight diameters.

" 2^c. Appendage of the left side of the second somite of the abdomen of the same specimen, enlarged eight diameters.

" 3. Appendage of the left side of the first somite of the abdomen of a male taken off Martha's Vineyard by the U. S. Fish Commission, Station 1029, enlarged eight diameters.

" 3^a. Appendage of the left side of the second somite of the abdomen of the same specimen, enlarged eight diameters.

" 4. *Ceraphilus Agassizii.* Dorsal view of female from Station 326, natural size.

" 4^a. Lateral view of the carapax of the same specimen, natural size ; *a*, anterior gastric spine ; *b*, rostrum ; *c*, orbital spine ; *d*, antero-lateral angle.

" 5. Lateral view of carapax and abdomen of a male from Station 317, enlarged two diameters ; *a*, *b*, *c*, *d*, the same as in fig. 4^a.

" 5^a. Dorsal view of carapax of the same specimen, enlarged two diameters ; *a*, *c*, *d*, the same as in fig. 4^a.

PLATE VIII.

Fig. 1. *Sabinea princeps.* Lateral view of female, natural size.

" 1^{a}. Dorsal view of carapax and anterior appendages of the same specimen, natural size.

" 1^{b}. Dorsal view of the terminal portion of the abdomen of the same specimen, natural size.

" 2. *Munidopsis curvirostra* Whiteaves. Dorsal view of male from Station 325, enlarged four diameters.

" 3. Appendage of the right side of the first somite of the abdomen of a male, from 220 fathoms, Gulf of St. Lawrence, enlarged eight diameters.

" 3^{a}. Appendage of the right side of the second somite of the same specimen, enlarged eight diameters.

PLATE IX.

Fig. 1. *Anchistia tenella.* Lateral view of female, enlarged four diameters.

" 1^{a}. Dorsal outline view of right eye and peduncle of antennula of the same specimen, enlarged eight diameters.

" 1^{b}. Outline of left antennal scale of the same specimen, enlarged eight diameters.

" 2. *Galacantha rostrata* A. Milne-Edwards. Dorsal view of male from Station 341, natural size.

" 2^{a}. Lateral view of carapax of the same specimen, natural size.

PLATE X.

Fig. 1. *Munida* sp. indet. Dorsal view of a large male, taken by the U. S. Fish Commission off Martha's Vineyard, Station 877, natural size.

" 2. *Pandalus carinatus.* Lateral view of female, enlarged two diameters.

" 2^{a}. First maxilliped of the right side of the same specimen, seen from beneath, enlarged twelve diameters.

" 2^{b}. Second maxilliped of the right side of the same specimen, enlarged twelve diameters.

" 2^{c}. Distal portion of right chelate leg of the same specimen, enlarged twelve diameters.

" 2^{d}. Lamellæ of the appendage of the left side of the first somite of the abdomen of the same specimen, seen from behind, enlarged twelve diameters; the marginal setæ and the distal portion of the outer lamella omitted.

" 2^{e}. Outline of tip of outer lamella of right uropod of the same specimen, enlarged four diameters.

" 2^{f}. Tip of telson of same specimen, seen from above, enlarged twenty-four diameters.

PLATE XI.

Fig. 1. *Pandalus carinatus.* Right mandible of the specimen figured on Plate X., seen from in front, enlarged twelve diameters.

" 2. Right first maxilla of the same specimen, seen from beneath, enlarged twelve diameters.

Fig. 3. Right second maxilla of the same specimen, seen from beneath, enlarged twelve diameters.

" 4. *Miersia gracilis.* Lateral view of young male, enlarged two diameters.

" 4ª. Distal extremity of the posterior leg of the left side of the same specimen, enlarged eight diameters.

" 4ᵇ. Rami of the appendage of the right side of the first somite of the abdomen of the same specimen, seen from behind, enlarged eight diameters; the marginal setæ of the outer ramus omitted.

" 4ᶜ. Portion of the base of the inner lamella of the appendage of the right side of the second somite of the abdomen of the same specimen, seen from behind and showing the small secondary stylet characteristic of the male, enlarged twenty-four diameters.

" 4ᵈ. Distal part of the second maxilliped of the right side of the same specimen, seen from below, enlarged eight diameters.

" 5. *Miersia Agassizii.* Lateral view of male from Station 330, natural size.

" 5ª. Second maxilliped of the left side of the same specimen, seen from below, enlarged eight diameters.

" 6. Distal extremity of the posterior leg of the right side of a male from Station 305, enlarged twelve diameters.

" 7. Inner lamella of the appendage of the left side of the same specimen, seen from in front, enlarged eight diameters.

" 8. *Meningodora mollis.* Lateral view of female, natural size. The lateral carinæ of the carapax are indicated by simple lines.

" 8ª. Outline of the right eye of the same specimen, seen from above, enlarged two diameters.

" 9. Second maxilliped of the right side of the same specimen, seen from below, enlarged eight diameters.

PLATE XII.

Fig. 1. *Miersia Agassizii.* Distal portion of the left mandible of the specimen figured on Plate XI. fig. 5, seen from beneath.

" 1ª. The same mandible seen from above.

" 2. First maxilla of the left side of the same specimen, seen from beneath.

" 3. Second maxilla of the left side of the same specimen, seen from beneath.

" 4. First maxilliped of the left side of the same specimen, seen from beneath.

" 5. *Meningodora mollis.* Distal portion of the right mandible of the specimen figured on Plate XI. fig. 8, seen from beneath.

" 5ª. The same mandible seen from above.

" 6. First maxilla of the right side of the same specimen, seen from beneath.

" 7. Second maxilla of the right side of the same specimen, seen from beneath.

" 8. First maxilliped of the right side of the same specimen, seen from beneath.

" 9. Distal extremity of posterior leg of the same specimen, enlarged twenty-four diameters.

" 10. *Miersia gracilis.* Endopod and exopod of the second maxilliped of the right side of the specimen figured on Plate XI. fig. 4.

All the figures, except Fig. 9, are enlarged eight diameters.

PLATE XIII.

Fig. 1. *Eumiersia ensifera.* Lateral view of female from Station 340, natural size.
" 2. Mandible of the left side of another female of about the same size and from the same station, seen from beneath, enlarged four diameters.
" 2ª. The same mandible seen from behind, enlarged four diameters.
" 3. First maxilla of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 4. Second maxilla of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 5. First maxilliped of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 6. Second maxilliped of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 7. Distal extremity of right chelate leg of the first pair of a male 44 mm. long from Station 330, enlarged about eight diameters.
" 8. Distal extremity of right chelate leg of the second pair of the same specimen, enlarged eight diameters.
" 9. Distal extremity of left leg of the fifth (?) pair of a female 108 mm. long from Station 308, enlarged four diameters.
" 10. *Pandalus acanthonotus.* Carapax and anterior appendages of the female from Station 321, enlarged four diameters.
" 11. Propodus and dactylus of the second maxilliped of the right side of the same specimen, seen from beneath, enlarged twelve diameters
" 12. *Pandalus tenuipes* Smith. Same part of second maxilliped of a specimen from 115 fathoms, off Martha's Vineyard (U. S. Fish Commission, Station 871), enlarged twelve diameters.

PLATE XIV.

Fig. 1. *Benthesicymus Bartlettii.* Diagrammatic sketch of the left side of the male, with most of the appendages omitted, natural size.
" 1ª. Similar dorsal view of the anterior part of the carapax and the anterior appendages of the same specimen, natural size.
" 2. Distal part of the mandible of the left side of the same specimen, seen from beneath, enlarged six diameters.
" 3. First maxilla of the left side of the same specimen, seen from beneath, enlarged six diameters.
" 4. Second maxilla of the left side of the same specimen, seen from beneath, enlarged six diameters.
" 5. First maxilliped of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 6. Second maxilliped of the left side of the same specimen, seen from beneath, enlarged four diameters.
" 7. Appendage (petasma) of the protopod of the appendage of the left side of the first somite of the abdomen, seen from in front, enlarged twelve diameters; *a*, process standing out, in its natural position, at nearly

right angles to the rest of the plate, but here represented as compressed nearly to the plane of the plate.

Fig. 8. *Amalopenæus elegans.* Diagrammatic sketch of the left side of the carapax and anterior appendages of a female from Station 328, enlarged about two diameters.

" 9. Mandibular palpus of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 10. Endognath of the first maxilla of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 11. Second maxilla of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 12. Outline of the antennal scale of the left side of the same specimen, seen from above, enlarged nearly four diameters.

" 13. Appendage (petasma) of the protopod of the appendage of the left side of the first somite of a male from Station 324, seen from in front, enlarged twelve diameters; *a*, process below the base; *b*, process between the middle and inner or distal parts of the plate, and which turns readily either in or out.

" 14. Same appendage from a specimen from Station 330, seen in the same position, enlarged twelve diameters; *a*, *b*, as in Fig. 13.

PLATE XV.

Fig. 1. *Amalopenæus elegans.* First chelate leg of the right side of the female figured on Plate XIV. fig. 8, enlarged about eight diameters.

" 2. Second chelate leg of the left side of the same specimen, enlarged about eight diameters.

" 3. First maxilliped of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 4. Second maxilliped of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 5. External maxilliped of the left side of the same specimen, enlarged four diameters.

" 5ª. Distal extremity of the same maxilliped, enlarged twenty-four diameters.

" 6. *Hymenopenæus debilis.* Diagrammatic sketch of the left side of the carapax and anterior appendages of a female from Station 323, enlarged about two diameters.

" 7. First maxilliped of the left side of a female from Station 326, seen from beneath, enlarged eight diameters.

" 8. Second maxilliped of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 9. External maxilliped of the left side of the same specimen, enlarged four diameters.

" 10. First chelate leg of the right side of the same specimen, enlarged four diameters.

" 11. Distal part of the third chelate leg of the right side of the same specimen, enlarged four diameters.

PLATE XVI.

Fig. 1. *Hymenopenæus debilis.* Mandibular palpus of the left side of the female from Station 326, seen from beneath, enlarged eight diameters.

" 2. First maxilla of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 2ª. Tip of endopod of the same maxilla, enlarged twenty-four diameters.

" 3. Second maxilla of the left side of the same specimen, seen from beneath, enlarged eight diameters.

" 3ª. Tip of the endopod of the same maxilla, enlarged seventy-two diameters.

" 4. *Sergestes arcticus* Kröyer. Antennal scale of the right side of a male from off Martha's Vineyard, U. S. Fish Commission, Station 1030, enlarged four diameters.

" 5. *Sergestes robustus.* Lateral view of male from off Martha's Vineyard, U. S. Fish Commission, Station 893, enlarged two diameters.

" 6. Distal extremity of chela of the second leg of the left side of another male from the same station, enlarged twenty-four diameters.

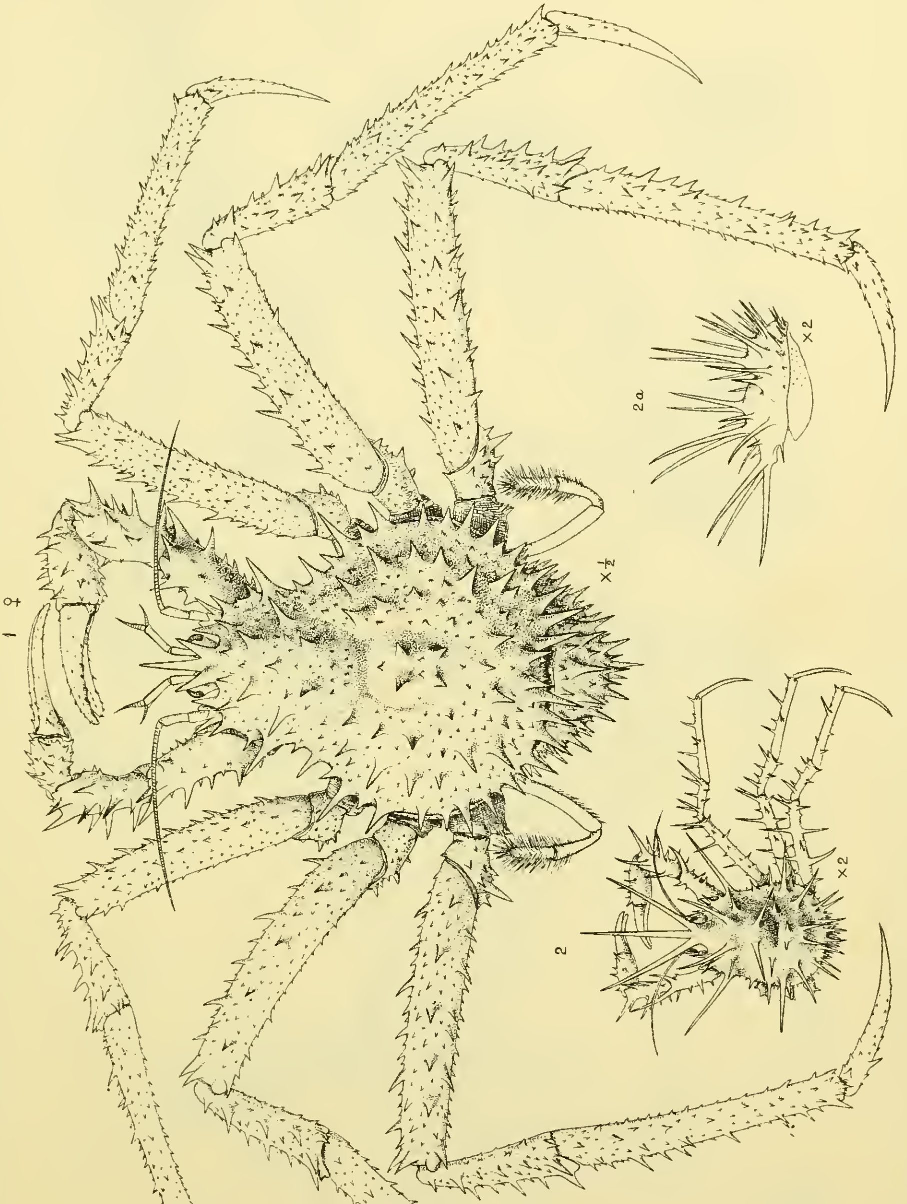
" 7. Antennal scale of the right side of the same specimen, enlarged four diameters.

" 8. Appendage (petasma) of the protopod of the appendage of the right side of the first somite of the same specimen, seen from in front, enlarged eight diameters; *a*, point of attachment to the protopod; *b*, hooked stylet; *c*, *d*, unarmed stylets; *e*, *f*, *g*, terminal processes armed with invaginated hooks; *h*, mesial line where the appendages of the two sides are hooked together.

" 8ª. Invaginated hook at the tip of process *f*, enlarged one hundred diameters.

" 8ᵇ. Invaginated hook from the side of the same process, enlarged one hundred diameters.

NEW HAVEN, CONN., June, 1882.

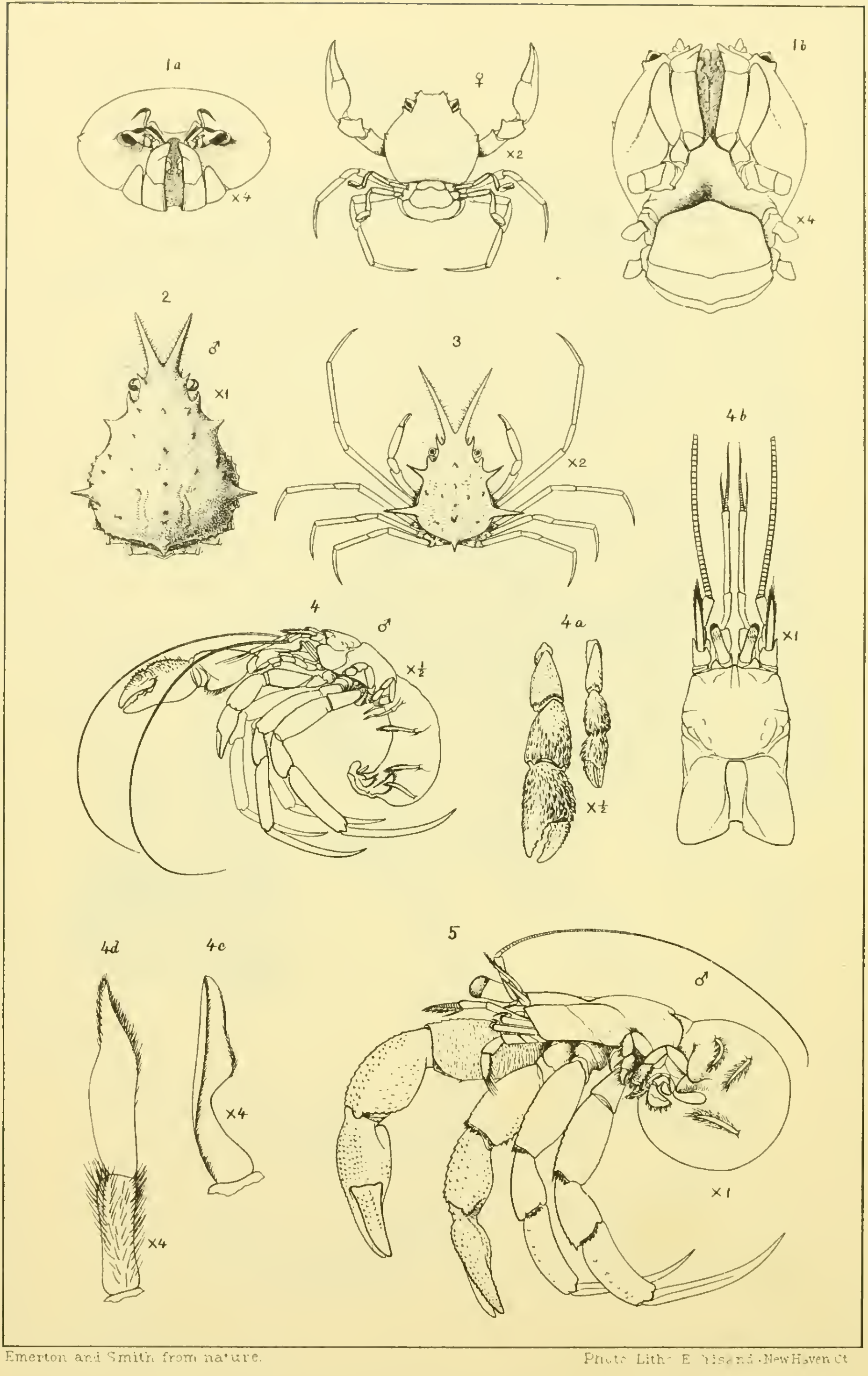


J.H. Emerton, from nature.

Photo Lith. E. Crisand New Haven Ct.

LITHODES AGASSIZII.

PLATE II


1a
×4
♀
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2
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4b
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4d
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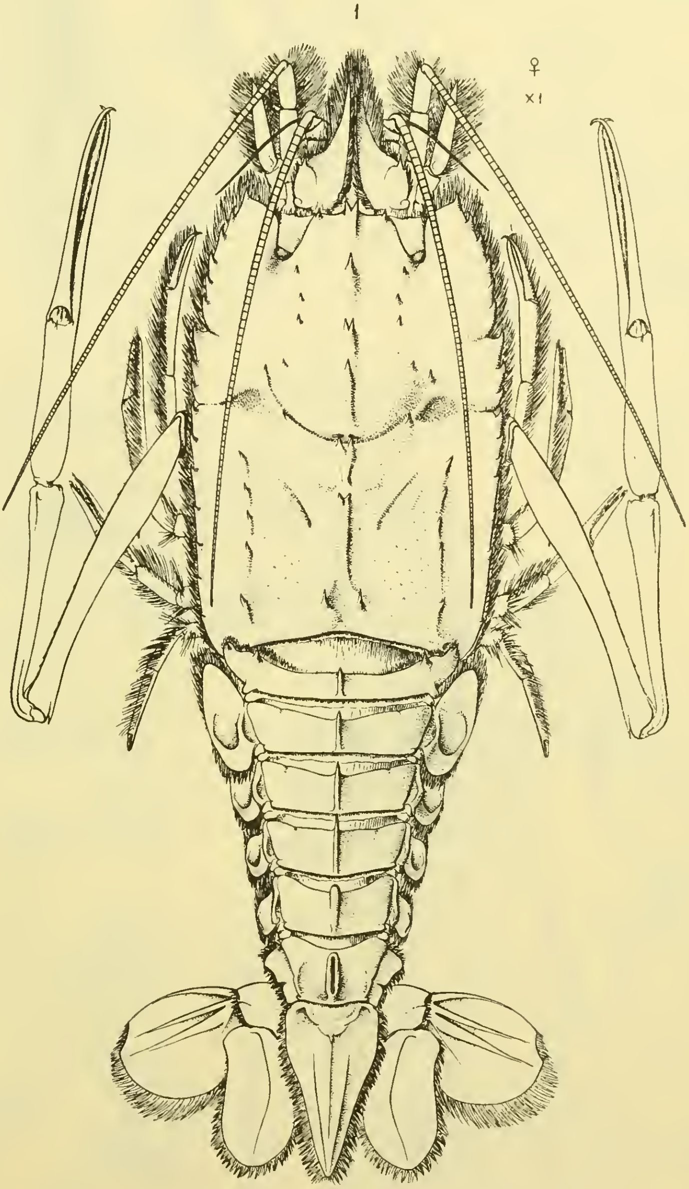
Emerton and Smith from nature.

Photo Lith. E. Crisand, New Haven Ct.

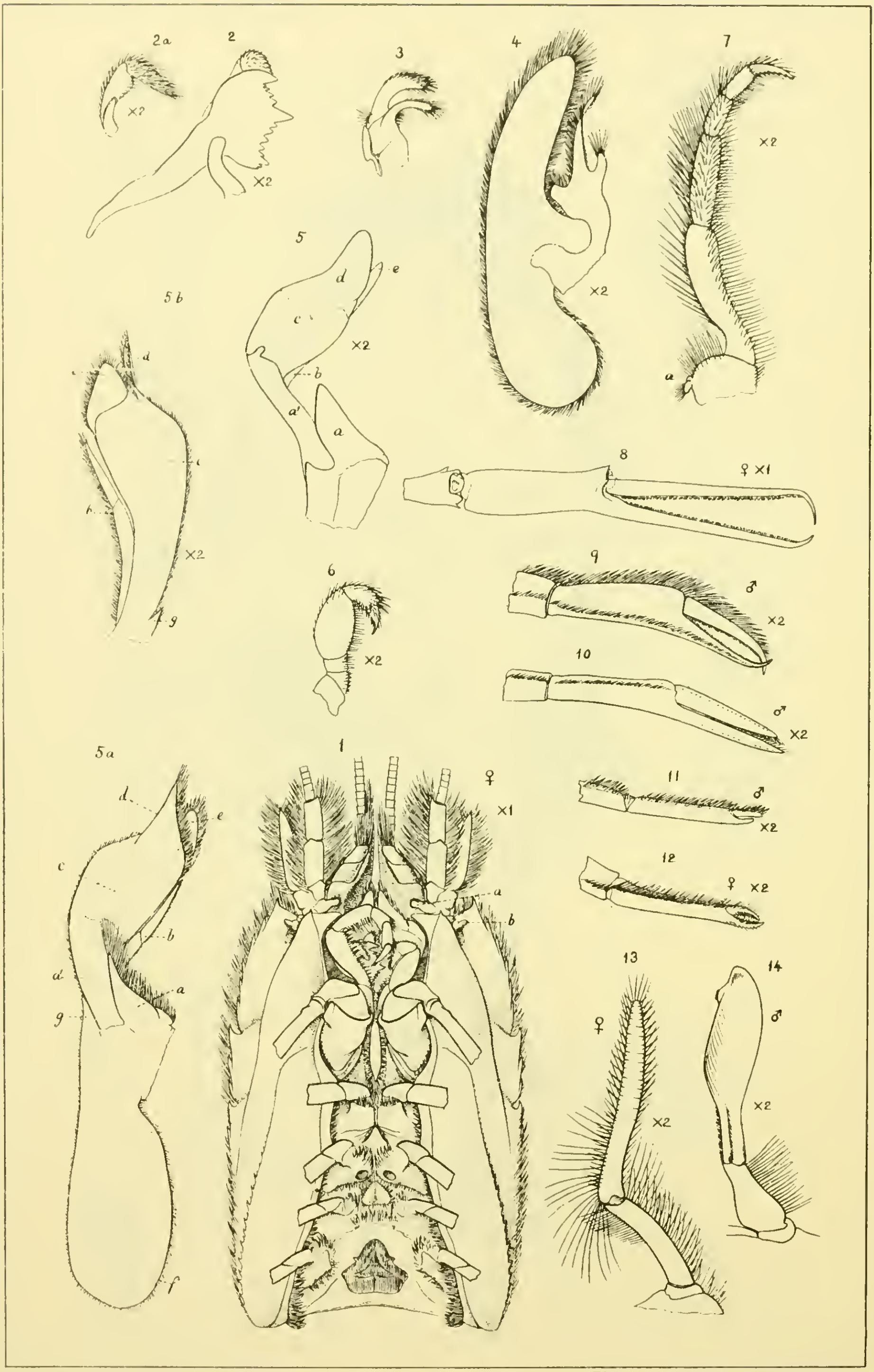
CYCLODORIPPE, AMATHIA, PARAPAGURUS, EUPAGURUS.



J. H. Emerton, from nature

Photo Lith. E. [illegible] New Haven

PENTACHELES SCULPTUS.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Emerton and Smith from nature
Photo Litho. E Crisand, New Haven, Ct

PENTACHELES SCULPTUS.

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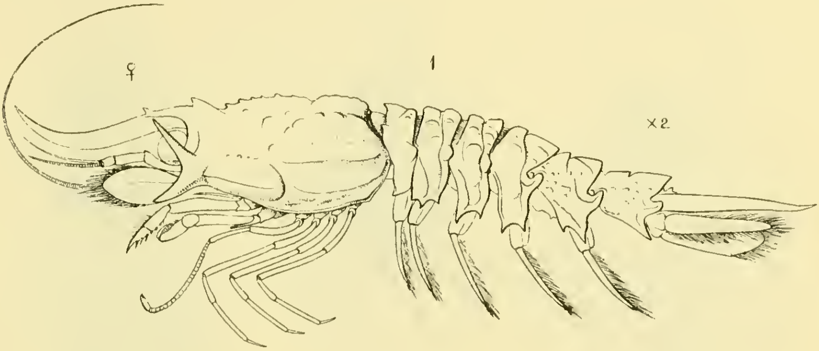

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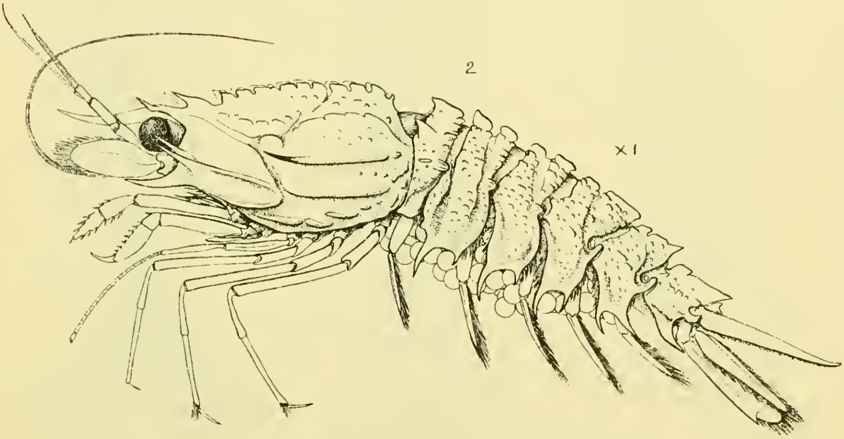

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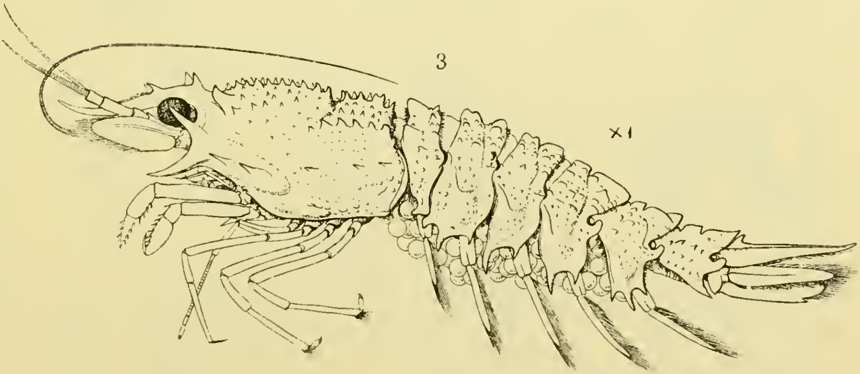
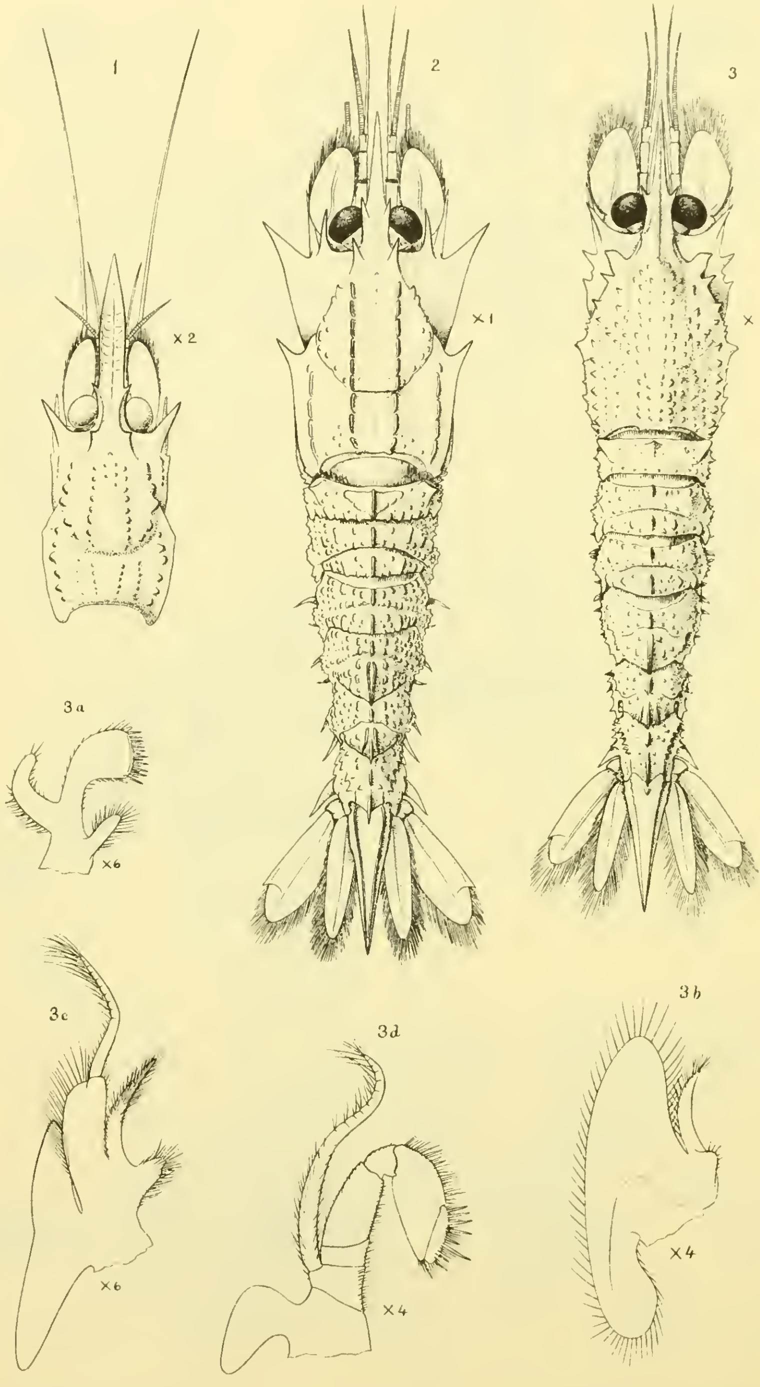


J. H. Emerton, from nature.

Photo. Lith. E. Crisand, New Haven, Ct.

RHACHOCARIS LONGIROSTRA, AGASSIZII AND SCULPTA.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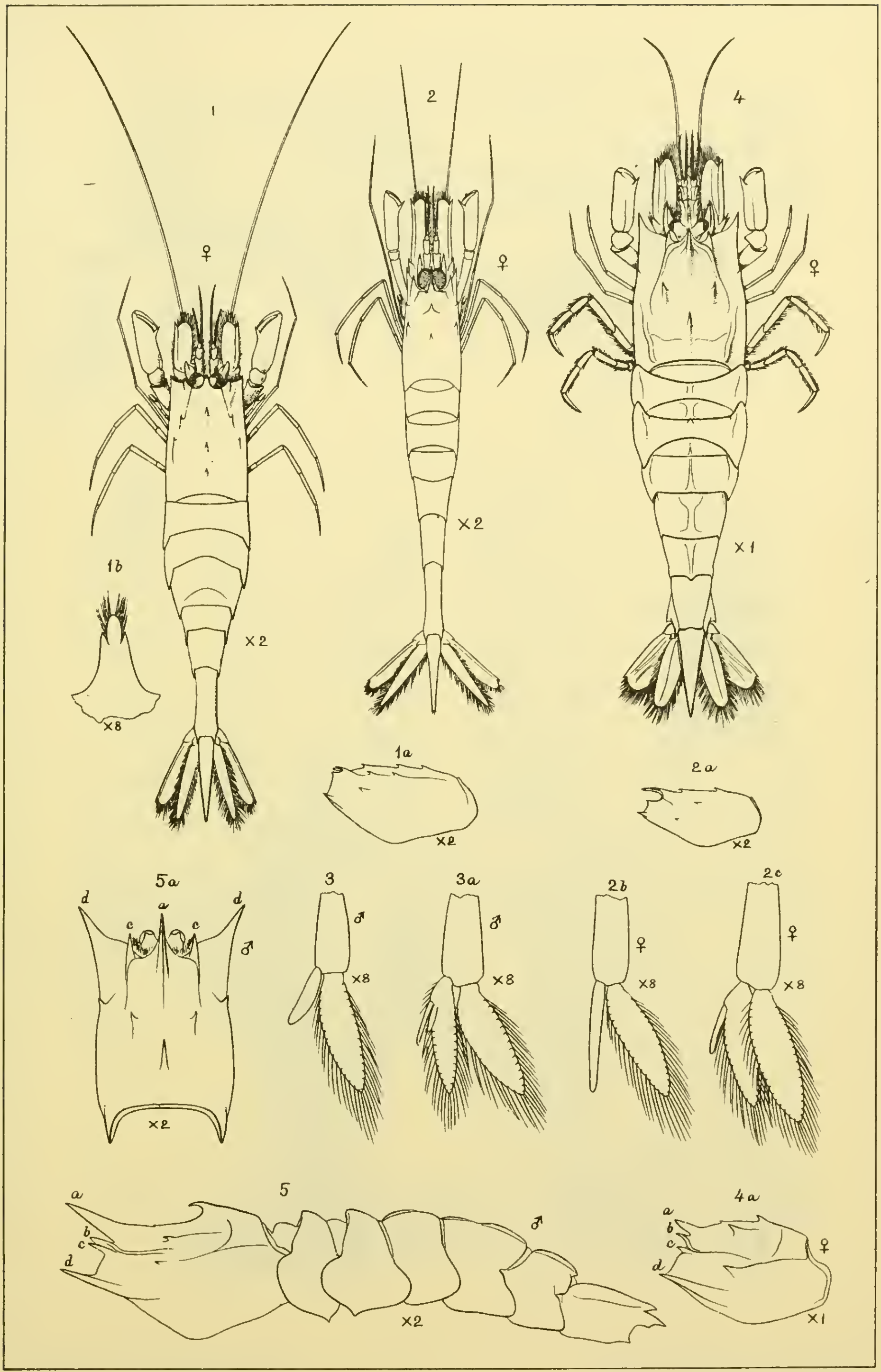
Emerton and Smith from nature

Photo. Lith. E. Crisand New Haven Ct.

RHACHOCARIS LONGIROSTRA, AGASSIZII AND SCULPTA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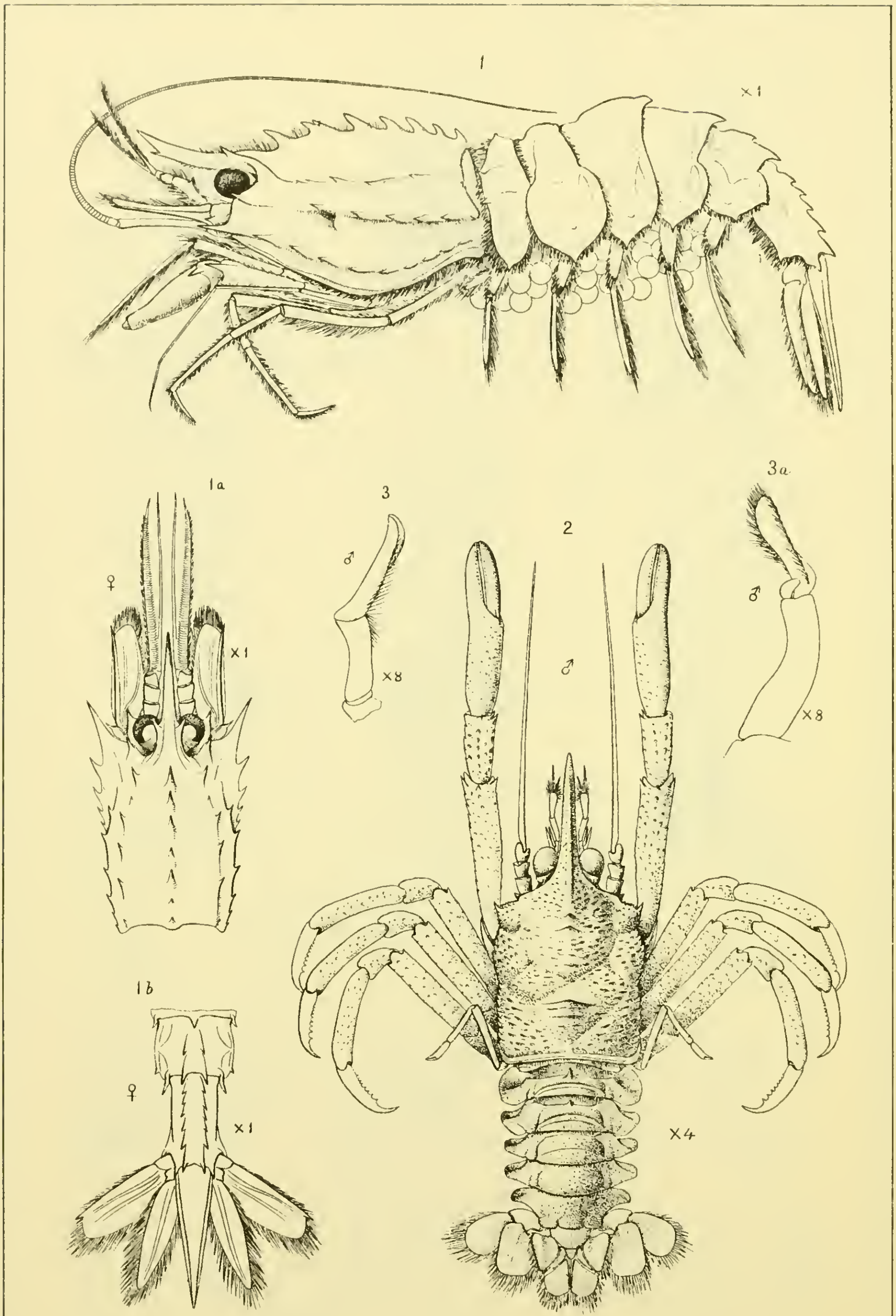
Emerton and Smith from nature

Photo. Lith. E. Crisand, New Haven, Ct.

PONTOPHILUS BREVIROSTRIS. P. GRACILIS. CERAPHILUS AGASSIZII.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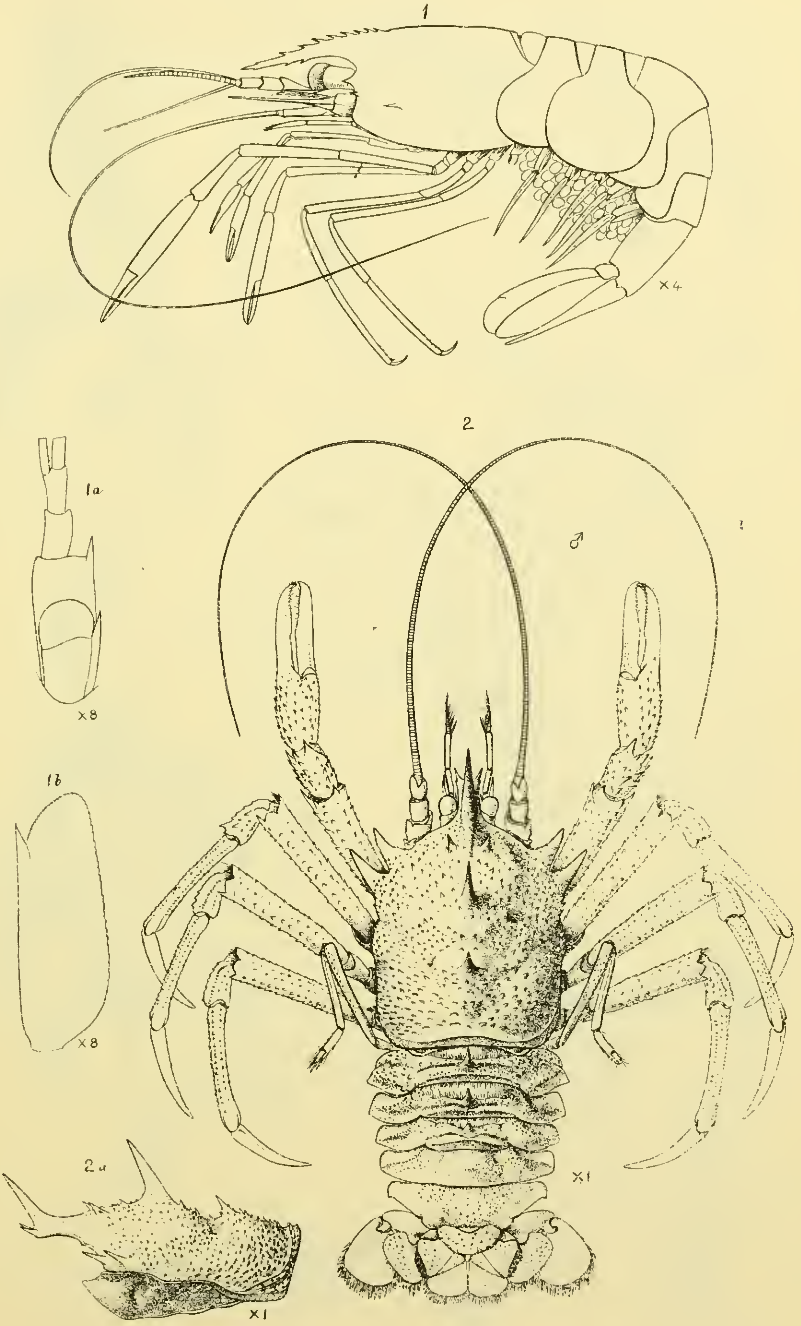
Emerton and Smith, from nature. Photo Lith. E. Crisand, New Haven Ct.

SABINEA PRINCEPS. MUNIDOPSIS CURVIROSTRA.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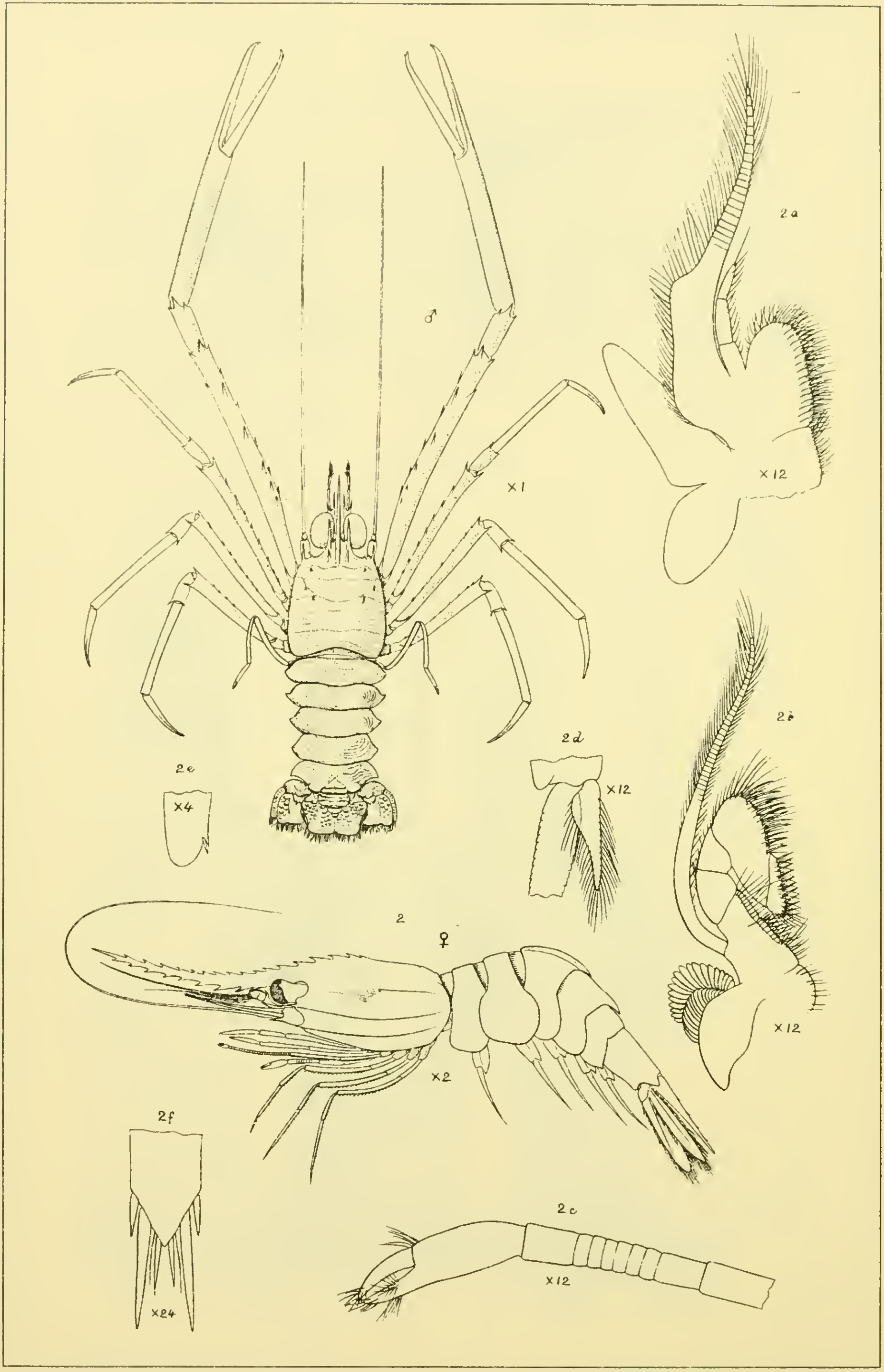
Emerton and Smith from nature.

Photo-litho. E. Crisand, New Haven.

ANCHISTIA TENELLA. GALACANTHA ROSTRATA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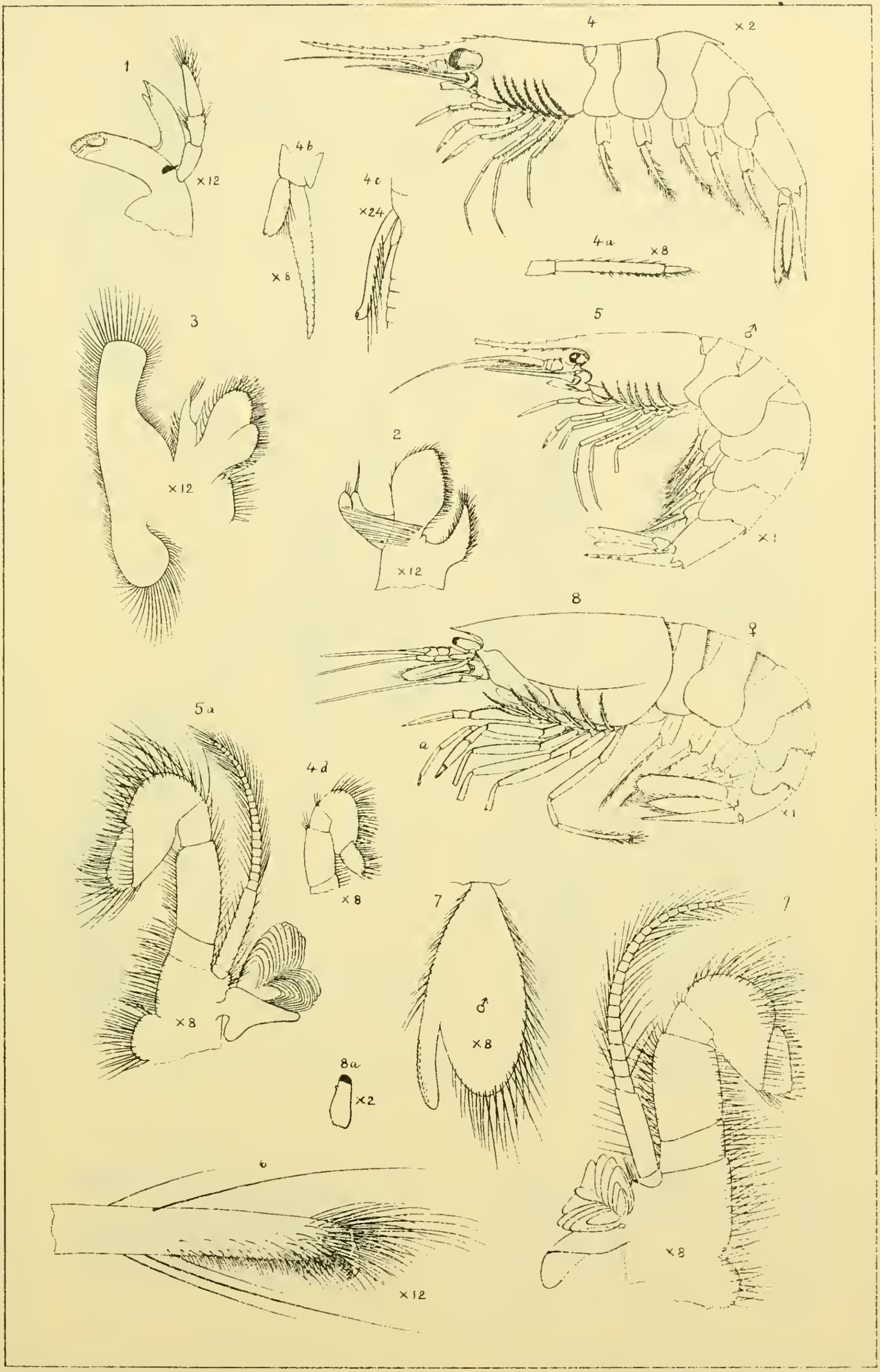
Emerton and Smith from nature.
Photo Litho. E. Crisand New Haven, Ct.

MUNIDA SPECIES. PANDALUS CARINATUS.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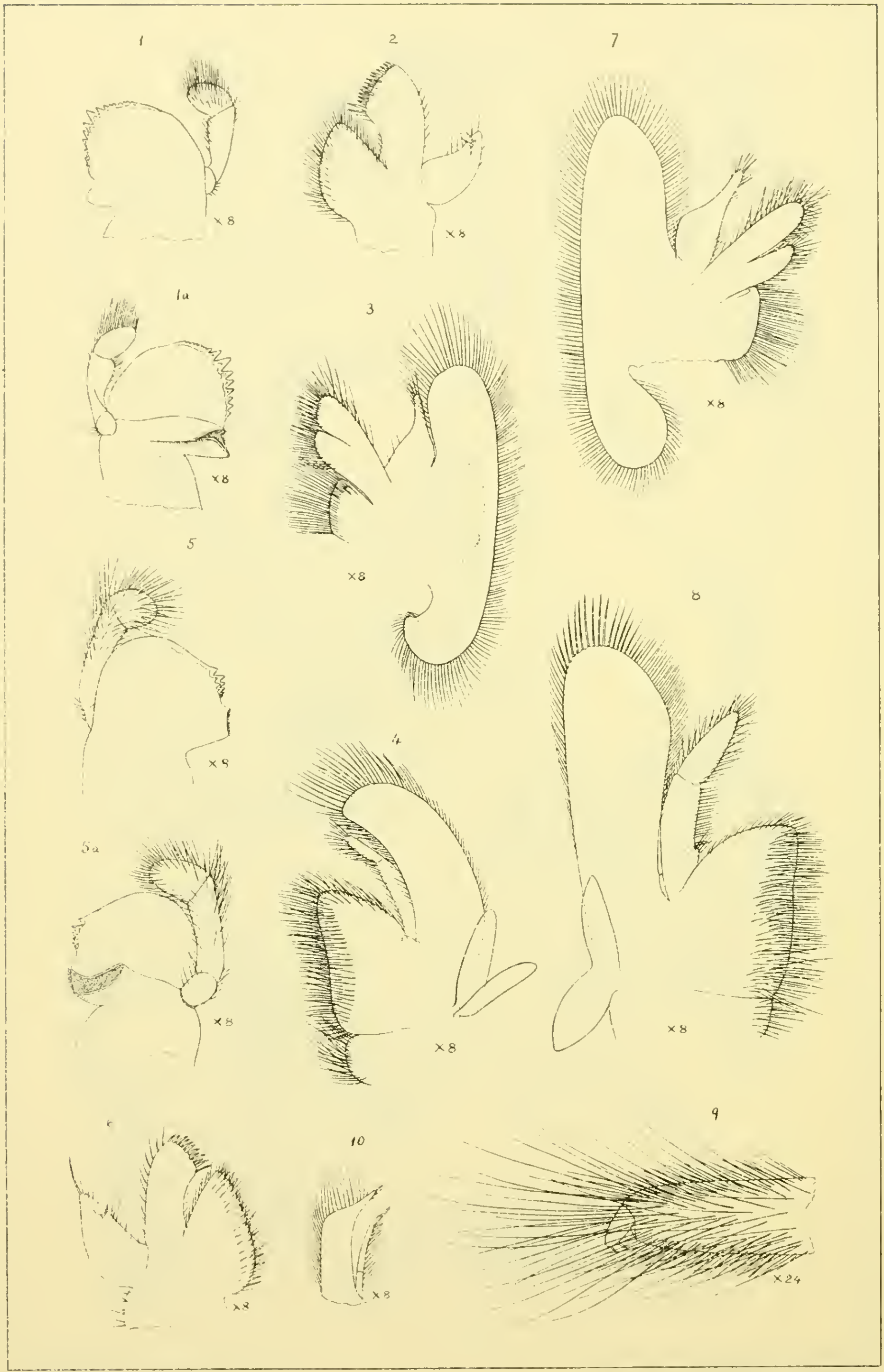
Emerton and Smith from nature. [illegible]

PANDALUS. MIERSIA. MENINGODORA.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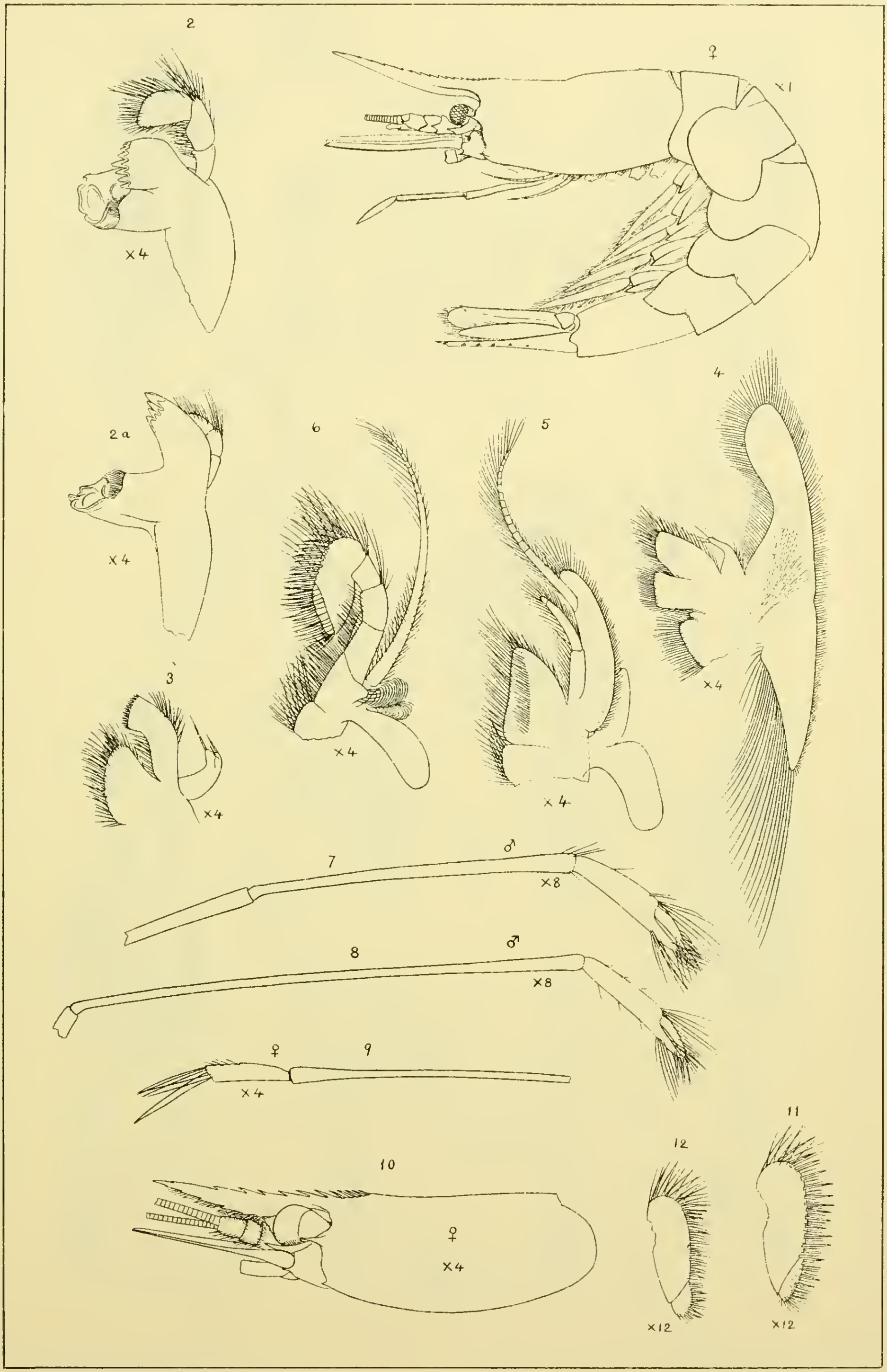
MIERSIA AGASSIZII. MENINGODORA MOLLIS.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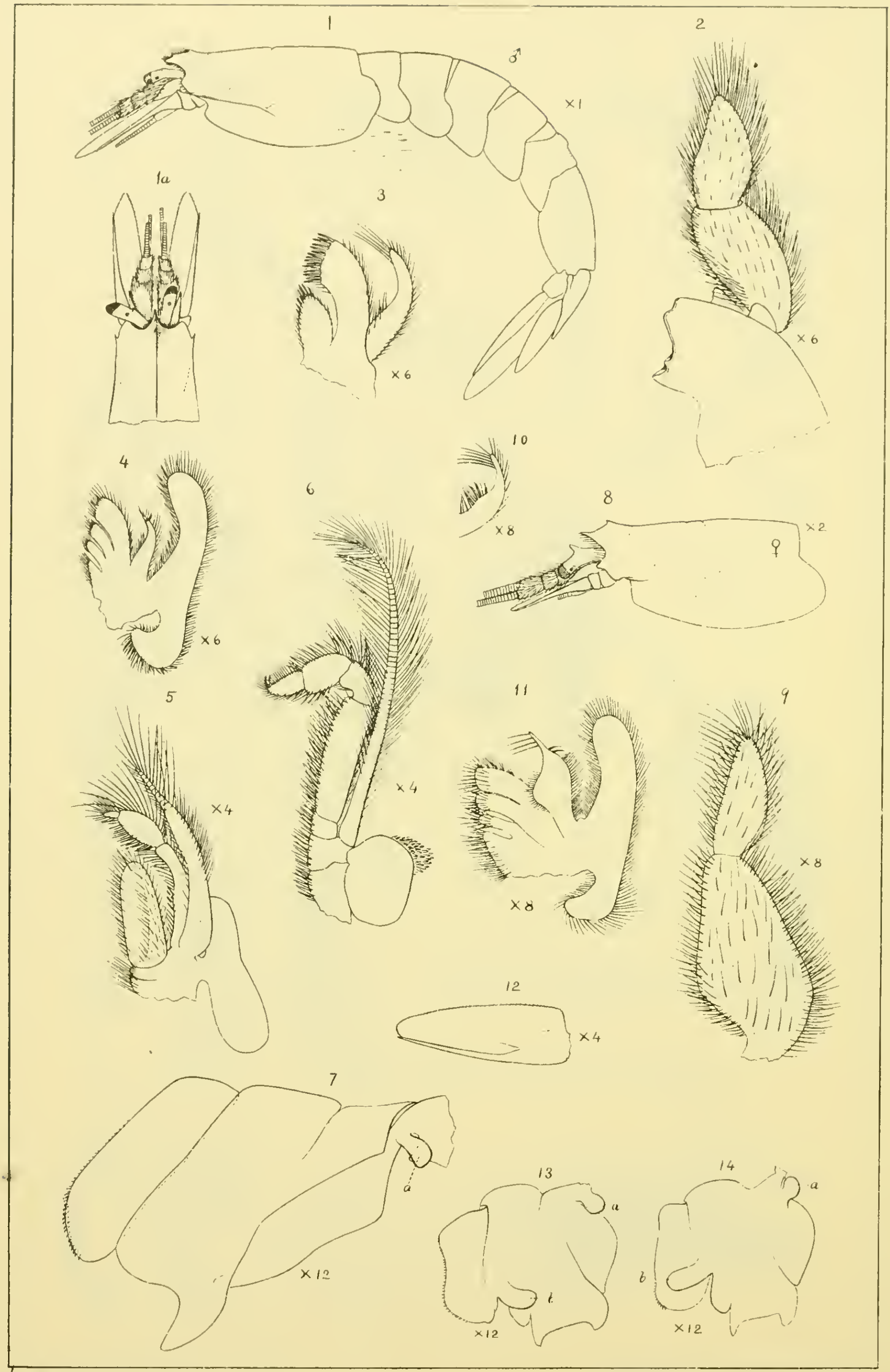
Emerton and Smith from nature.
Photo Lith: E. Crisand, New Haven, Ct.

EUMIERSIA ENSIFERA. PANDALUS ACANTHONOTUS.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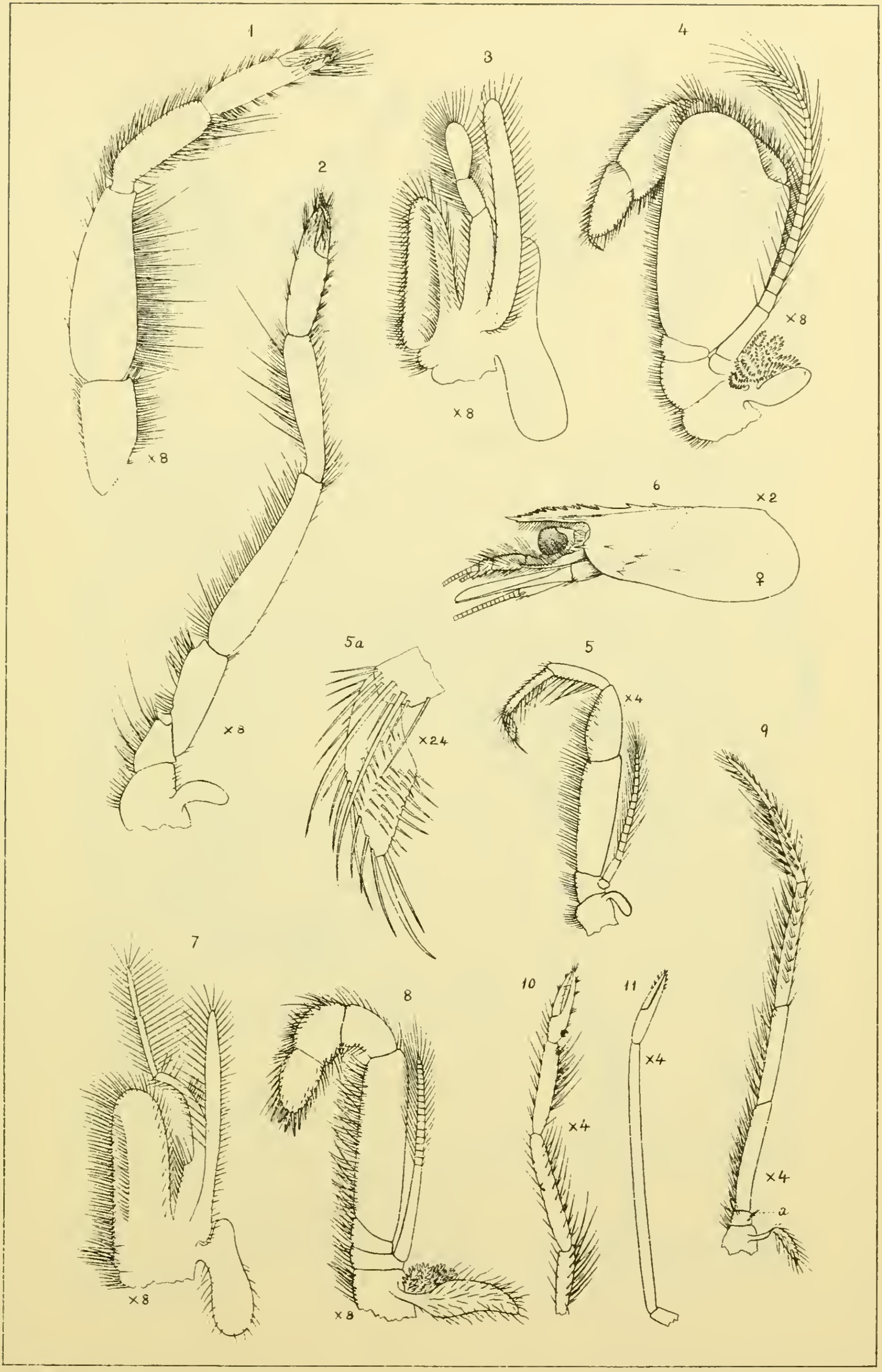
S. I. Smith, from nature. Phot. Lith. E. Crisand, New Haven, Ct.

BENTHESICYMUS BARTLETTI. AMALOPENÆUS ELEGANS.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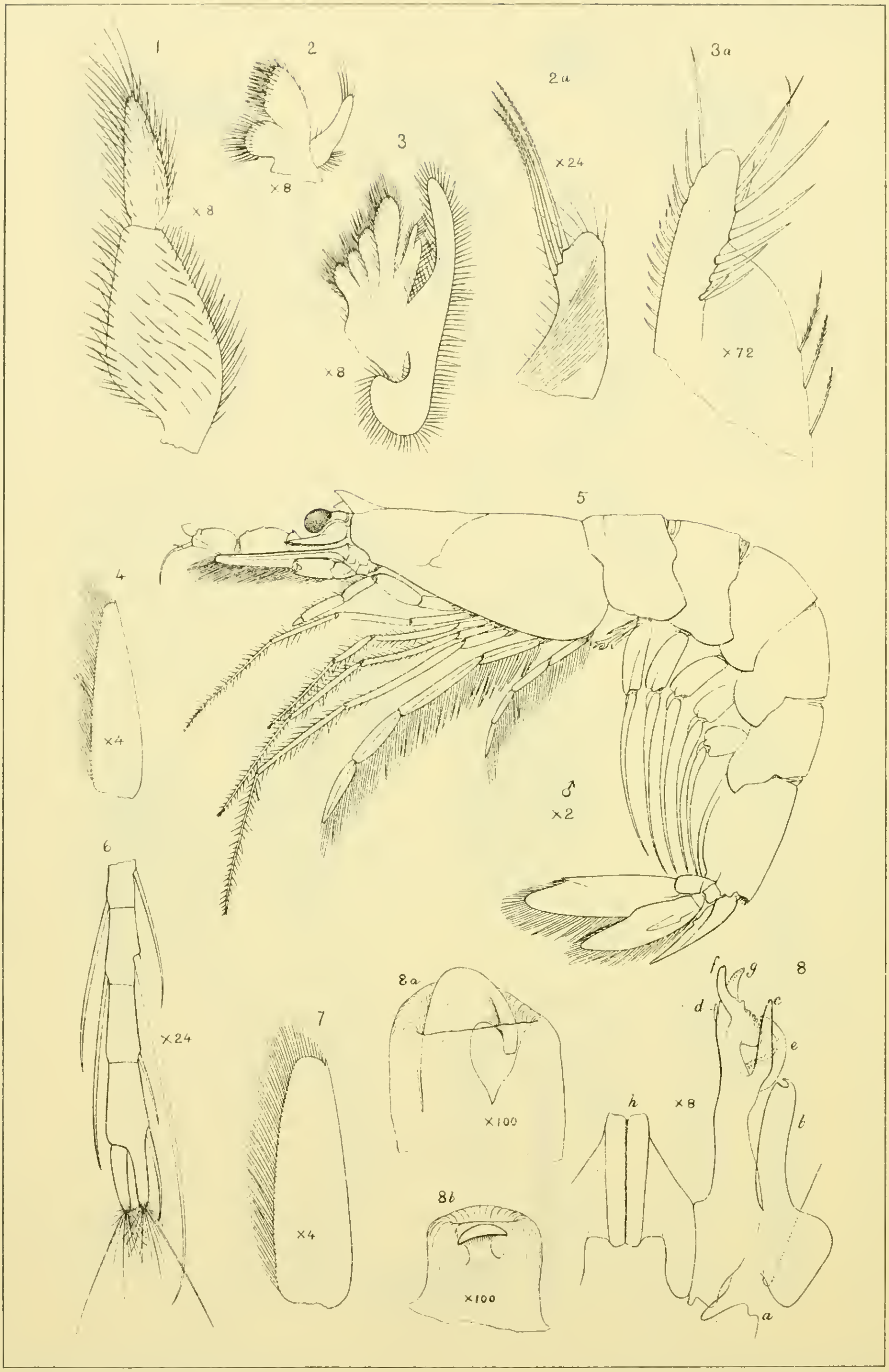
S I Smith, lith, from nature

Photo Litho E. Crisand, New Haven Ct

AMALOPENÆUS ELEGANS. HYMENOPENÆUS DEBILIS.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Emerton and Smith from nature.

Photo Lith. F. Crisand, New Haven, Ct.

HYMENOPENÆUS DEBILIS. SERGESTES ROBUSTUS.

No. 2. — *Bibliography to accompany "Selections from Embryological Monographs" compiled by* Alexander Agassiz, Walter Faxon, *and* E. L. Mark.

II.†

ECHINODERMATA.

By Alexander Agassiz.

It will greatly facilitate the study of the history of the development of Echinoderms by recalling here that in 1836, Thompson (J. V.) first called attention to the remarkable development of Comatula ; that next came in 1844 the observations of Sars (M.) on the direct development of Echinaster, and in 1846 of Asteracanthion. This was followed in 1848 by the confirmation of these observations by Desor and Agassiz (L.) In 1847 Dufossé traced many of the stages of development of *Echinus esculentus.* From 1846 to 1855 Johannes Müller published his memoirs on the development of the different orders of Echinoderms. They have formed the basis of all the subsequent publications on the same subject. The more important of these in their chronological order are those of Allman, Carpenter, Thomson (C. W.), and Goette on the Embryology of the Comatulæ ; of Krohn, Agassiz (A.), and Metschnikoff on the Embryology of the Sea-urchins ; of Koren and Danielssen, Baur, Metschnikoff, and Selenka on the Holothurians ; of Schultze, Agassiz (A.), Metschnikoff, and Apostolides on the Ophiurans ; and of Van Beneden, Agassiz (A.), and Metschnikoff on the Starfishes. While the memoirs of Müller, Agassiz (A.), Metschnikoff, and others treated of Tornaria as a Starfish larva, the subsequent publications of Metschnikoff and of Agassiz (A.) proved that Tornaria was the larva of Balanoglossus. The literature of this part of the subject is, therefore, repeated here ; it will also appear in that of the Vermes, to accompany the illustrations of Balanoglossus. It is taken for granted that no special record is necessary of the older Jahresberichte of Leuckart, of Keferstein, of the Zoölogical Record, and of the recent Berichte of Hoffmann and Schwalbe and of Carus ; and that such observations as are found in the notices and reviews of special memoirs must be sought for in the chapters on Echinodermata of these volumes. [*] before a title denotes that I have not seen the work.

Cambridge, July 1, 1882.

Agassiz, Alexander.

On the Embryology of *Asteracanthion berylinus* Ag. and a Species allied to *A. rubens* M. T. *Asteracanthion pallidus* Ag. *Proc. Amer. Acad. Arts & Sci.*, VI. pp. 106–114. 18 figs. *1863.*
Also separate. *1863.* 8 pp.

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† I. Crustacea, by Walter Faxon. See *Bull. Mus. Comp. Zöol.*, IX. No. 6, p. 197, March, 1882.

Agassiz, Alexander (*continued*).

Embryology of the Starfish. Published in December, 1864, advance Pt. I., Vol. V. *Contrib. Nat. Hist. of U. S. of* L. Agassiz. 63 + 7 pp., 8 pl.

(Development of *Asteracanthion berylinus* and *A. pallidus.*)

See also Pt. I. *Mem. Museum Comp. Zoölogy at Harvard College*, V. No. 1, 1877, where the same is found.

Abstr. of this Memoir by A. Agassiz in *Ann. Sci. Nat.*, 1865, III. pp. 367–377.

Embryology of Echinoderms. *Mem. Amer. Acad. Arts & Sci.*, IX. pp. 1–30. *1864.* 38 cuts.

(Development of *Toxopneustes Dröbachiensis, Ophiopholis bellis, Amphiura squamata, Cucieria Fabricii.*)

Notes on the Embryology of Starfishes (Tornaria). *Ann. Lyceum Nat. Hist.*, VIII. pp. 240–246, Pl. II. New York, *1866.*

Preliminary Report; Echini, and Starfishes, dredged in Deep Water between Cuba and Florida Reef. *Bull. Mus. Comp. Zoöl.* I., No. 9, pp. 253–308. *1869.* Also abstr. transl. by Troschel, *Arch. f. Naturg.*, I. 1870, pp. 127-149.

(On the young stages of Echini, II. p. 279.)

Note on Lovén's article on *Leskia mirabilis* Gray. *Ann. Lyceum Nat. Hist.*, IX. pp. 242–245. New York, *1869.* See also Lovén's and Lütken's articles on *Leskia.*

Revision of the Echini. *Illust. Cat. Mus. Comp. Zoöl., Harvard College*, No. 7. Cambridge (U. S.), *1872–74.* xii + 762 pp., 94 pl., 69 cuts.

Reviewed by P. De Loriol. *Arch. Sci. Phys. et Nat.*, L. pp. 401–411. *1874.* Also reviewed by Edmond Perrier in *Revue des Cours Scientifiques for* 1874

(Part IV. Structure and Embryology of the Echini. 69 cuts. Also young stages in Parts II. and III. *passim.*)

The History of Balanoglossus and Tornaria. (Separate in 1872.) *Mem. Amer. Acad. Arts & Sci.*, IX. pp. 421–436, Pl. I.–IV. *1873.*

Zoölogical Results of the "Hassler" Expedition. 1. Echini, Crinoids, and Corals, by Alexander Agassiz and L. F. De Pourtalès. *Illust. Cat. Mus. Comp. Zoöl.*, No. 8. Echini, by A. Agassiz. 1-23 pp., 4 pl. Cambridge, Feb. *1874.*

(Young *Cœlopleurus*, young *Hemiaster Philippii.*)

Embryology of the Ctenophoræ. *Mem. Amer. Acad.*, X. pp. 357–398. 5 pl. *1874.*

(See systematic position and affinities of Echinoderms and Ctenophoræ, pp. 379, and following.)

Agassiz, Alexander (*continued*).

Sur la Fertilisation artificielle de deux Espèces d'Étoiles de Mer. *Arch. Zoöl. Expér. et Génér.*, III. p. xlvi. *1874.*

(*Asteracanthion pallidus* and *A. berylinus.*)

On Viviparous Echini from the Kerguelen Islands. *Proc. Amer. Acad. Arts & Sci.*, XIII. pp. 231–236, 6 cuts. *1876.* Also *Journ. de Zool.*, V. pp. 277–278. *1876.*

(Young *Hemiaster.*)

North American Starfishes. *Mem. Museum Comp. Zoölogy at Harvard College*, V. No. 1. *1877.* iv + 136 pp. 20 pl.

(Part I. pp. 3-83, Pl. I.–VIII. See above, Embryology of the Starfish, orig. pub. in 1864.)

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Also same, Die paläontologische Entwickelung der See-Igel im Vergleich zu ihrer individuellen Entwickelung, abstract transl. by E. Krause. *Kosmos,* X. pp. 214–217. *1881.*

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Report on the Echinoidea, dredged by H. M. S. "Challenger," during 1873–76. London, *1881.* 321 pp., 64 pl. *Rep. Voy. "Challenger," Zoöl.*, III. Pt. IX.

(Young stages of Echini, *passim ; Cidaris, Cœlopleurus, Echinothuriæ, Palæotropus, Spatagocystis, Cystechinus, Urechinus, Pourtalesia, Aërope, Brissus ; viviparous Goniocidaris* and *Hemiaster.*)

Agassiz, Alexander and Elizabeth C.

Seaside Studies in Natural History. Marine Animals of Massachusetts Bay. Radiates. Boston, *1865* and *1871.* 153 pp., 185 figs.

(Chapter on Embryology of Echinoderms, p. 143.)

Agassiz, Alexander. *See* (p. 130) **Pourtalès, L. F. de.**

Drawing of Young Holopus from Bahia Honda, Cuba, by A. Agassiz. Pl. II. *Bull. Mus. Comp. Zoöl.*, V. p. 213. *1878–79.*

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Observations on the Growth and Bilateral Symmetry of Echinodermata. *Philos. Mag.* [3], V. pp. 369–373. *1834.*

Observations sur les Progrès récens de l'Histoire Naturelle des Échinodermes. 21 pp. In Monographies d'Échinodermes. 2de Livraison. Neufchâtel, *1841.* Also *Ann. Mag. Nat. Hist.*, IX. pp. 189–197, 296–302. *1842.*

(Notice of Embryological works, p. 12.)

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Lectures II. and III. On Development of Echinoderms; p. 12. *Traveller*, of Dec. 22, 1848.

Die Entwickelung eines Seesternes, Echinaster. (From *Daily Evening Traveller*, Boston, Dec. 22, 1848.) *Archiv f. Anat. Phys. und Wiss. Med. 1851.* pp. 122–124.

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Allman, George James.

On a Pre-Brachial Stage in the Development of Comatula, and its importance in relation to certain Aberrant Forms of Extinct Crinoids. (Read Feb. 16, 1863.) *Trans. Roy. Soc. Edinburgh*, XXIII. pp. 241–252, Pl. XIII. *1864*.

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On an apparently New Form of Holothuria. *Ann. Mag. Nat. Hist.*, March, 1862, IX. pp. 189–191, Pl. XI.

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Sur la Soudure des Organes Génitaux des Oursins Réguliers. *Arch. Néerl.*, XI. pp. 97–116, Pl. IX., X. *1876*.

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1e Thèse. Anatomie et Développement des Ophiures. *Archives de Zool. Expér. et Génér.*, X., Pl. VII.–XII. *1881*.

(Thèses présentées à la Faculté des Sciences de Paris, 1881. Paris, No. d'Ordre 471. 104 pp., 6 pl.)

Baer, K. E. v.

Neue Untersuchungen ueber die Entwickelung der Thiere. *Froriep's Neue Notizen*, XXXIX. p. 38.

(Ei des Seeigel.)

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(Pluteus of Echini.)

Balfour, Francis M.

A Treatise on Comparative Embryology. Vol. I. xi + 492 + xxii. pp., 275 figs. London, *1880*. Vol. II. xi. + 655 + xxii. pp., 429 cuts. London, *1881*.

(Chapter XX., p. 453. Echinodermata.)

Balfour, Francis M. (*continued*).

Also German transl. by Dr. B. VETTER: Handbuch der vergleichenden Embryologie. I. Jena, *1880*.

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(Zweite Abhandlung, Metamorphose und Entwickelung der *Synapta digitata*.)

Bell, F. Jeffrey.

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Exhibition of an Immature Echinoid. *Proc. Zöol. Soc. London*, pp. 356–358. *1880*.

(Palæolampas, the immature form of an Echinolampas.)

Observations on the Characters of the Echinoidea. Part III. On Some Genera and Species of the Temnopleuridæ. *Proc. Zöol. Soc. London*, June 1, 1880. pp. 422–440, Pl. XLI.

(Describes the young forms of several species.)

On the Apparent Retention of a Sur-Anal Plate by a Young Echinometra. *Journ. Linn. Soc. London*, Zoöl., XV. pp. 318–320. *1881*.

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See also p. 119, GEGENBAUR, CARL.

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(*Bipinnaria* and Ophiuran larvæ.)

Beneden, P. J. Van (*continued*).

Ueber Zwei Larven von Echinodermen. *Froriep's Tagsb. Fortschr. Nat. u. Heilk.*, I. p. 257. *1850.* Same as above.

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(p. 7, fig. of Gastrula of *Psammechinus miliaris.*)

Billings, E.

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(Refers to young stages of Echinoderms for comparisons.)

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For continuation, see (p. 131) Sars, Koren, and Danielssen.

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No. 3. — *On a Revision of the Ethmoid Bone in the Mammalia, with special Reference to the Description of this Bone and of the Sense of Smelling in the Cheiroptera.* By HARRISON ALLEN, M. D., Professor of Physiology in the University of Pennsylvania.

IN the Bulletin of the Museum of Comparative Zoölogy dated February, 1880, I described briefly some peculiarities of structure I had detected in the ethmoid bone of the Cheiroptera.* It is my purpose in this communication to extend my remarks in the same direction, and by way of introduction to give a brief account of the ethmoid bone as it is met with in the mammals generally.

The ethmoid bone in mammals lies within the ethmoidal notch of the frontal bone, and is in all but a few groups (e. g. in Primates, Quadrumana, and some of the genera of Felidæ) protected laterally by the descending process of the frontal bone, the orbital process of the palatal bone, and the orbital process of the orbito-sphenoid bone. In the nasal chamber it is protected above by the nasal bone and in part by the vomer. Its several portions lie in the nasal chamber and in the frontal and sphenoidal sinuses. With a near approach to accuracy, it may be said that the ethmoid is included between the following openings : the optic, the ethmoidal and the sphenoidal foramina, and the lachrymal and the infra-orbital canals. The suture between the palatal bone and the superior maxilla in the roof of the mouth corresponds nearly to the anterior limit of the ethmoturbinals.

The Nomenclature of the Subdivisions of the Ethmoid Bone. — The ethmoid bone of the human subject is described by anatomical writers as composed of a pair of lateral masses, sponges, or labyrinths, united to a perpendicular plate by means of the cribriform plate, the projection of the former above the latter constituting the crista-galli. Each lateral mass in turn is composed of ethmoid cells, and presents upon its median surface two scrolls. The "cones of Wistar" are a pair of symmetrical ossicles appended to the lateral masses posteriorly, and are not of olfactory significance.

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* The prodrome of this memoir, as announced in the above-named paper, has not been followed in all respects. The points of difference, however, do not demand special attention.

The departures from this arrangement in the ethmoid of quadrupeds are so numerous and pronounced that an adherence to a similar plan of description is not satisfactory.

In proposing modifications, I will use the following language : —

The ethmoid bone is composed of the *meso-ethmoid* and two *ethmoturbinals.* The former includes the perpendicular plate and the crista galli; the latter, as in human anatomy, the lateral masses of the bone. These terms are in general use by English writers. The *nasoturbinal* is an ethmoturbinal plate projecting in front of the remaining plates, and forming the superior limit to the series, as seen on the median surface of a longitudinal (sagittal) section. — The "cones of Wistar" form the *sphenoturbinals.*

Each ethmoturbinal element is an *olfactory plate.* The space between any two plates is called an *olfactory interspace.*

Each olfactory plate is, as a rule, plicated, and each plication in turn forms an *olfactory fold.* The free projecting ends of the olfactory plates constitute the *olfactory lobes.*

The ethmoturbinal plates are divided into two groups, the *ectoturbinals* and the *endoturbinals.* The *ectoturbinal plates* are those which lie in a space defined by the frontal bone and the superior maxilla. This space communicates with the nasal chamber at the interspace between the nasoturbinal and the first endoturbinal, as well as by a large oval opening behind the maxillo-turbinal and the vertical plate lying between the superior maxilla and the ethmoid. The ectoturbinal plates are arranged on the lateral sides of the chamber, from which they project inward toward one another, but never to a degree to be seen on the median surface as this is seen in a longitudinal section of the skull.

The *endoturbinal plates* are arranged in a series lying beneath as well as medianly to the foregoing. They are placed in oblique parallel rows from above downward, and are best seen in a longitudinal (sagittal) section of the skull. Each ethmoturbinal plate has a base where it arises from the cribriform plate. The upper border of each plate is its *frontal border,* while its lower border is its *palatal border.**

The space between the meso-ethmoid and the ethmoturbinal is the *septoturbinal space.* The lamina uniting the ethmoturbinals one with another constitutes the *transverse lamina.* Its posterior portion unites with the vomer, and may receive the name of the *turbino-vomerine lamina.* Its anterior portion lies in front of the last named. The sphenoturbinals are furnished with olfactory plates that join the vomer, thus crossing the septoturbinal space.

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* The terms ecto- and endoturbinal are named with reference to the relations they entertain to the nasal chamber. The ectoturbinals do not appear, with a few exceptions, on the lateral wall of the undissected nasal chamber (see Plate I. fig. 1), while the endoturbinals so appear, or can be made to do so, by producing the axes of the olfactory plates entering into them.

The surface of the ethmoid bone entering into the construction of the brain case is called the *encranial surface.* It exhibits a *perforate* or *cribriform plate,* and a *non-perforate plate* placed posteriorly to the foregoing. The perforate plate answers in position to the ectoturbinals, the endoturbinals in great part, and the septoturbinal space. The non-perforate space covers the sphenoturbinals and the lowest of the endoturbinals. The encranial surface may be subdivided, for convenience in description, into surfaces which correspond to the divisions of the ethmoid as seen from the nasal chamber. Thus the septoturbinal, the ectoturbinal, and the endoturbinal surfaces are easily distinguished.

The Literature of the Ethmoid Bone.—That the terminology of the ethmoid bone at present in use needs revision can be readily shown by a reference to the literature of the subject.

E. F. Gurlt (Handbuch der Vergleichenden Anatomie der Haus-Saugthiere, Berlin, 1843, Vol. I. p. 81) describes the ethmoid on the basis of the human bone. He identifies the nasoturbinal as the superior conch and the first endoturbinal as the middle conch. All parts not appearing on the median surface he groups under the head of the "Labyrinth."

H. Strauss-Durckheim (Anatomie Descriptive et Comparative du Chat, Paris, 1845, p. 385) gives the sphenoturbinals as equivalent to the "cornet de Bertin," and forming the third division of the bone. The second division is the group of plates seen only in the *cat* and its congeners. It is a development from the transverse lamina. All the remaining portion of the ethmoturbinal, comprising as it does the bulk of the bone, Strauss-Durckheim calls the first or superior division of the bone. The space between the two ethmoturbinals on a level with the lower border of the chamber of the ectoturbinals and the equivalent to the ethmoidal notch of human anatomy receives the name of the "écartement des anfractuosités supérieures." The mesoturbinal is named the "lame verticale moyenne."

Owen (Archetype and Homologies of the Vertebrate Skeleton, 1848) named the meso-ethmoid the prefrontal, and gave to the ethmoturbinals the name which they have since borne. In his elaborate work on the Anatomy of the Vertebrates, Owen restricts the term *ethmoturbinal* to the lower plates only of the mass (the endoturbinals of this paper), as seen in the *hog*. In the description of the ethmoid in this animal the word "labyrinth" is also used, showing that the term had not, in the mind of the writer, supplanted that of "ethmoturbinal." — In the *tapir* the cribriform plate is said to be reticulate, with long radiating meshes. The ethmoturbinal in this animal consists of many convolute divisions, and each is perforated by many foramina. — In the *horse* the ethmoturbinal is separated from the nasoturbinal. The same language is employed in describing the ethmoids of other animals. — The *giraffe* exhibits the upper folds of the labyrinth coalescing in the moderately long and deep ethmoturbinal. — In the *dog* the horizontal folds of the "labyrinth" are four in number. Here by the word "labyrinth" the median surface of the ethmoturbinals (endoturbinals) is intended. Indeed, throughout the descriptions in this work, the term *ethmoturbinal* includes the periphery of the lateral mass, excepting that portion lying above the cribriform plate. Thus the os planum and the middle and lower plates of the median surface are ethmoturbinal, while the intervening structures and the superior division are vaguely included in the "labyrinth." This is evidently so in the account of these parts in the *giraffe*, where the upper folds of the labyrinth are said to coalesce and to be produced into the ethmoturbinal. In like manner, the ethmoturbinal forms the part identical with the transverse lamina.

J. Chatin (Les Organs des Sens dans la Série Animale, Paris, 1880, p. 241) describes each olfactory plate as it appears upon the median surface, where it is called a "cornet." The "cornet supérieur" is the same as the nasoturbinal; the "cornet ethmoidal," the equivalent of the endoturbinals. No attempt is made to describe the ethmoturbinal. It is simply stated to be most bizarre in its construction. In the *kangaroo* the maxilloturbinal is called the "volute ethmoidal."

Kitchen Parker ("On the Structure and the Development of the Skull in the Pig," Philosoph. Trans., Vol. CLXIV. Part I., 1874) calls the first plate of the ectoturbinals the "upper turbinal"; the first endoturbinal, the "middle turbinal." The maxilloturbinal forms the "lower turbinal." The nasoturbinal is called the "nasal turbinal." In advance of the olfactory region Parker recognizes two turbinals, viz. the maxilloturbinal and the alinasal turbinal. The first of these has been already noticed. The last named is a ledge-like point within the nostril continuous with the ledge supporting the maxilloturbinal. A very good general view of the ethmoid as seen in the *hog* is shown in Plate XXXV. of the above memoir, — the ectoturbinals being as yet imperfectly developed.

Dr. Elliott Coues ("Osteology and Myology of the Opossum," Memoirs of the Boston Nat. Hist. Soc., II. 62) treats of the ethmoturbinal as synonymous with the lateral mass, and of the perpendicular plate as being probably homologous with a pair of coalesced prefrontals. He further ambiguously states that the "spongy convolutions" are borne on either side of the perpendicular plate. Respecting the arrangement of the olfactory plates, he remarks, "It would be difficult even if it were desirable (!) to describe the details of the spongy convolutions."

The description in Bronn's Klassen und Ordnungen des Thier-Reichs (Bd. VI. Abtheil. X. 52) embraces a general account of the bone. No attempt is made to discriminate between the olfactory plates. The ethmoturbinal mass is named the labyrinth, and composed of thin rolled plates of bone enclosing the ethmoidal cells.

The Method employed by the Author in studying the Ethmoid Bone. — The study of the ethmoid bone is greatly facilitated by immersion of the bone in an acid solution which is sufficiently strong to remove the bone-salts. When the bone is detached from the skull, the delicate folds are easily decalcified by a solution of nitro-muriatic acid of not greater strength than eight drops of the acid to an ounce of water. When the entire skull, say of an animal of the size of a horse or dog, is subjected to the acid solution, a strength from a half-drachm to a drachm of acid to the pint of water will be required. For small, delicate skulls, such as those of the bats, a fluid slightly acidulated, say two drops to the ounce of water, is sufficient. Immersion from six to twelve hours is needed for the smaller specimens, and perhaps a renewal of the fluid for a second period as long as the first for the larger ones. The specimen is next washed and soaked through several waters, and afterwards can be preserved in alcohol. The ethmoid bone thus prepared can be studied with signal advantage over the natural bone, since a dissection can be effected with ease, and without danger of mutilation. I think perhaps the best way to obtain a satisfactory preparation for general purposes of comparison is to secure a macerated skull * of the animal whose ethmoid is desired, and, after the bone-salts have been removed, to bisect the skull longitudinally at one side of the line of the vomer, and reserve one half of the specimen for study of the median surface of the ethmoid bone. The encranial surface will be seen in the same specimen. Next, to make a transverse (frontal) section of the opposite piece, in such a manner as to divide transversely all the parts of the ethmoid bone directly in advance of the cribriform plate. The section must be made concentrically to the plane of the cribriform plate, and of course to include the mesoethmoid. The proximal surface of such a preparation embraces a section of the ethmoturbinals and of the septoturbinal space, and gives at a glance the plan of the bone. The parts of both specimens can be handled with freedom, as the botanist can press aside the several parts of a flower, and afterward, without violence, return them to their natural positions.

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* Care must be taken to protect the freshly macerated skull from the attacks of a voracious dipterous larva, that is capable of destroying the delicate structures of the ethmoid in an incredibly short space of time.

If it be desired to retain the mucous membrane in connection with the olfactory plates, the superficial parts, together with the temporal and masseter muscles and the eyes, should be first removed to enable the acidulated fluid to act directly upon the bony surfaces. After the bone-salts have been dissolved, a saw may be employed to sever the denser surrounding structures, such as the frontal bone, the zygomata, the hard palate, etc., reserving the interior parts to be divided by the scissors or the knife. By this means irregular laceration of the plates and membranes is avoided, and the parts are kept free from bone-dust.*

A General Account of the Ethmoid Bone.

At the risk of repeating here and there a fact already incorporated in the above list of terms, I will now give a succinct account of the ethmoid bone, as studied in a number of well-known mammals other than the bats.

The Encranial Surface.—The cribriform plate is divided into two portions, one lying over the septoturbinal space, and the other answering to the ethmoturbinal spaces. The latter is again divided into two portions, a superior and an inferior, which correspond to the ectoturbinal and endoturbinal spaces respectively. In the Carnivora,† so far as examined, these divisions are abruptly angulated one to the other. The line separating them is distinctly ridged, and is conspicuous in the *raccoon* and the *dog*, but inconspicuous in the *sloth*. This ridge is the basal encranial aspect of the first endoturbinal, and the foramina ranged on the sides and at the tip of the ridge afford openings of exit to the olfactory nerves supplying the sides of the plate. Indeed, all the olfactory nerves excepting those of the septoturbinal spaces are similarly placed with respect to basal lines of the ethmoturbinal plates. The first endoturbinal, being the largest of the series, secures for its base a more decided line than is the case with the others. The septal openings are arranged in a single straight line parallel to the crista galli.

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* I desire to return my acknowledgments to the Academy of Natural Sciences of Philadelphia for the use of crania from its collection. When it is seen that a decalcified skull subsequently subjected to the making of sections of the ethmoidal region is one practically expended in the cause of science, it will be conceded that no inconsiderable privilege was accorded me.

† For purposes of comparison, the ethmoid bone of the dog and otter are figured side by side in Plate I. But the bone of the otter is not separately described.

The simplest arrangement of foramina is seen when a row of openings lies parallel to the median border of the encranial surface, and another is seen similarly disposed along the lateral border. The successive degrees of complication on the surface are dependent upon the extent that the basal ridges extend medianly from the last-named row.

A general idea of the plan of the ethmoidal plates can be thus formed by the study of the encranial surface. The number of the foramina present, the size of the basal ridges, the extent of the non-perforate space, will be found to hold an exact relation to the number and size of the olfactory plates, and indirectly to the functional importance of the olfactory region.

As a rule, the encranial ectoturbinal surface is rounded in form, and of greater diameter than the surface for the endoturbinals. In the *cat* the cribriform plate is everywhere narrow, the ectoturbinal surfaces being separated by a median frontal process, on either side of which septal foramina are arranged. The crista galli is not developed at the anterior third of the endoturbinal region. The ridge for the first endoturbinal is scarcely longer than the width of the septoturbinal space at its side. The second endoturbinal closely resembles the first. The foramina of the last-named plates are continuous at the lateral border of the cribriform plate. The ridge of the third plate is indeterminate, the foramina being large and clustered.

In the *dog* (Plate I. figs. 1, 2) the ectoturbinal surface is subrounded, higher than it is broad, with the septoturbinal space widened superiorly. The ectoturbinal ridges and foramina are displayed laterally, and lie on the level of the descending portion of that portion of the frontal bone articulating with the orbitosphenoid. The first endoturbinal ridge is three times the width of the related septoturbinal space. The second is two thirds the length of the first. The third ridge is, as in the *cat*, indeterminate, and the foramina are clustered.

In both the *cat* and the *dog* the non-perforate space is exceedingly small. In the former it is reduced to a mere elevated rim, and in the latter it is concealed by the anterior edge of the presphenoid. The non-perforate space is well seen in the seal, *Phoca vitulina*, the *opossum*, and the *peccary*. In the *otter*, the *bear*, and other Carnivora, it is nearly absent, so that the posterior border of the cribriform plate is also the posterior border of the bone. The non-perforate space is in close relation with the orbitosphenoid and the presphenoid, so that the sphenoidal sinuses may be occupied by the lowest of the endoturbinals.

As is well known, the sphenoidal turbinals in *man* are distinct ossicles, lying between the ethmoturbinals and the presphenoid. In some mammals, as the sloth, the presphenoid has a group of plates which closely resemble an olfactory plate of the ethmoturbinal, but differing therefrom by the fact that the plates unite with the crest at the basal surface of the cranio-facial axis, instead of being separated by an intervening space, as in the ethmoturbinals. A slight tendency in the same direction is seen in the *peccary*. Is this group of plates homologous with the sphenoturbinals of man?

In the *otter* (Plate I. fig. 4), the *mink*, the *weasel*, and the *bear*, the frontal sinuses are occupied by the ectoturbinals. When such frontal development is pronounced, the ectoturbinal division of the ethmoid is of a circular form in transverse section and on the encranial surface, while the endoturbinal division is longer than wide.

The Nasal Surfaces. — Each ethmoturbinal plate is attached to the cribriform plate proximally, to the os planum laterally, and, it may be, to an associate-turbinal distally. Upon the median surfaces the plates remain free, and either end simply, or exhibit a tendency at their ends to form two revolute parts, the convex surfaces of which appear upon the superficies of the lateral wall of the nasal chamber. In a longitudinal section of the nose the median aspect of the ethmoturbinal is thus made up, in the last-named variety, of the rounded convexities of the plates and the spaces between them. The uppermost of the plates is much longer than the others. . . . The lateral aspect of the nasal chamber at the ethmoturbinal region is, therefore, made up simply of those plates which have a common plane. The surface gives no impression of the number of the plates present; for some may not reach the median surface, and from this circumstance be not seen or accounted for. Neither is the surface a guide to the length of the plates, since, as the reader has already seen, the cribriform plate is wider above than below, so that a plate extending from the last-named to the median surface is of necessity longer than one extending between similar points below.

In the transverse section it will be seen that a number of the plates have failed to reach the median surface. In the *dog* (Plate I. fig. 1), for example, the ectoturbinals are four in number. The first is obliquely placed from above downward, and within outward. Two conspicuous convolutions are present at the distal end, the lower one of which alone lies toward, but not on, the median surface. The second plate possesses a single convolution, which is directed outward. The third and fourth are very short, biconvolute, and directed upward and forward. None of the ectoturbinals appear on the longitudinal surface of the nasal chamber. The first endoturbinal is long and complex. It is directed forward and upward, and nearly touches the median convolution of the first ectoturbinal. It is biconvolute, but the parts are short and not incurved. Three secondary convolutions are seen on the sides of the plate, — one on the upper, and two on the lower aspect. Both of the latter reach the surface of the longitudinal section. The second endoturbinal is the longest of the series, and touches the septum. A single primary convolution is directed upward, and much convoluted. A single upper and two lower secondary convolutions are seen, as in the first plate, but they are less conspicuous. The third and remaining plate is the smallest of the endoturbinals, and arises from the os planum, as this structure is seen in the section. It is directed upward and inward, to appear on the longitudinal section. It presents a single convolution. Immediately beneath the last plate, the transverse plate or lamina is seen. The nasoturbinal is seen in the section as a minute non-convolute structure, intermediate between the two sets of plates.

The endoturbinals are always arranged in tiers one above another. All originate from the lateral surface. In the *dog* (Plate I. fig. 2) the second of the plates descends, and may follow the curve of the sides and the bottom of the nasal chamber as far as the meso-ethmoid, along which it ascends a short distance. The plates in this portion of the ethmoturbinal in the dog are from three to four in number. The olfactory plates tend to unite anteriorly. Thus two to three plates unite to form the nasoturbinal in the *dog*. The lower endoturbinal plates unite in front by broad, thin plates. These, taken collectively, constitute the transverse lamina of Strauss-Durckheim. It is constantly present, stretching across the septoturbinal space to the vomer, against which it rests.

The ectoturbinal plates may be rudimentary or absent. They would appear to be absent in the *ape*, at least in the adult. In *man* they are also absent. The *opossum* has two ectoturbinals; the *cat*, two to three; the *hog*, five; the *ox*, eight. In the *seal* the ectoturbinals are developed to a greater degree than the endoturbinals.

The olfactory plates are either simple at their ends or convolute. Their anterior ends are often produced forwards in a series of tongue-like projections, which have received the name of the olfactory lobes. The projection known as the nasoturbinal is the most conspicuous of these. The lobe on the first endoturbinal is always well developed. The endoturbinals of the *hog* are without marked lobulations. The Carnivora and the Rodentia, as far as examined, possess lobes on all the folds. In the *opossum* two of the plates are simple, the remainder are convolute. Occasionally a convolute fold arises from the side of a plate instead of from the end, as in the larger plates of the Carnivora and the Ruminantia. The arrangement of the endoturbinals, as seen in the median surface of the ethmoturbinals, is much the same as in other Carnivora.

The septoturbinal space is in all mammals narrow, and indeed may be obliterated here and there where the endoturbinal plates lie in contact with the septum. Such a point of contact is evident in the *macaque*, *M. nemestrinus*, where a depression is seen on the septum answering in position to the first endoturbinal plate. Similar depressions are seen in the *bats*, as in *Antrozous* and *Corynorhinus*.

In *Cebus* (Plate II. figs. 1, 2) the absence of an ectoturbinal series, and the endoturbinal series being restricted to a single plate bearing incisures upon its posterior border, and retaining upon its anterior surface a deflected and abortive nasoturbinal (uncinate process), an example is afforded of the manner after which the ethmoid bone is modified in passing from the quadrupedal form to the primate. In man the interval between the endoturbinal series and the lateral aspect of the bone is occupied by a number of cellules. These being absent in *Cebus* and *Macacus* (the only genera examined), it would appear as though the chief difference between these forms and the human ethmoid lay in the development of the ethmoid cells.

The human ethmoid bone (Plate II. fig. 3), viewed from beneath, furnishes, as in *Cebus*, an aborted nasoturbinal in the "uncinate process," and the rugose under surface of the single endoturbinal plate in the "middle turbinated bone."

A Special Account of the Ethmoid Bone in the Horse, the Peccary, the Sloth, the Cat, the Seal, and the Mole. — I have thus endeavored to sketch the general plan of arrangement of the ethmoid bone in the mammals, and to indicate the relations that the several parts hold one to another. Before describing the bone in the Cheiroptera, I propose giving detailed accounts of the ethmoid in the cat, the seal, the peccary, the sloth, and the mole; with the object of bringing together some widely diverse examples, and presenting descriptions which will be sufficiently detailed to permit of comparisons being made with those which will follow in the concluding portion of this paper.

In the *horse* (Plate II. figs. 4, 5) the endoturbinal aspect of the encranial surface is concealed from the brain case at its upper third by a transverse plate apparently of the frontal bone, but which in reality is an ossification of the ethmoid. The foramina of the endoturbinal surface are arranged elaborately in a crescent extending across the anterior end. The foramina of the ectoturbinal surface are seen in five transverse triangular or clavate clusters.

The ethmoid, studied from its lateral aspect, exhibits a trenchant distinction between the endoturbinals and the ectoturbinals by a thin septum extending across the great cranio-facial sinus. Both the turbinal sets lie in this sinus, connected by a thin papyraceous lamina, save at the anterior fourth of the ectoturbinal series, where it is firmly connected by the ends of the olfactory plates to the descending process of the frontal bone, as well as with the line of junction this process effects with the orbitosphenoid and the frontal bones.

Seen in transverse section, the turbinal mass exhibits sharply the division between the two sets of plates. The ectoturbinals are eight in number, including the nasoturbinal. The endoturbinals are five in number, and preserve the order already described as existing in the hog. The last plate sends backward a single folium within the sphenoidal sinus, so that the olfactory apparatus extends a short distance posterior to the encranial surface.

Seen from the median aspect, the nasoturbinal is seen to assume enormous proportions, being much wider than any of the endoturbinals. Four of the endoturbinals are visible, and all are markedly biconvolute, the convexities of the scrolls alone appearing on the general surface. Anteriorly each plate is seen ending simply at the bases, but toward the apices they are more or less lobate. The first and second plates project beyond the transverse lamina.

A small but distinct plate crosses the septoturbinal space obliquely at the orifice of the sphenoid sinus. The septum is distinctly foliated opposite the third, fourth, and fifth plates.

In the peccary,* *Dicotyles torquatus* (Plate III. figs. 1–3), the encranial surface is uniformly concave, and presents scarcely any angulation inferiorly. Hence, the indications of separation of the ectoturbinals from the endoturbinals are indistinct. The basal aspects of the endoturbinal plates form well-defined lines on the cribriform plate, about which are arranged a number of little pits. From the bottom of these lie the foramina of the olfactory nerves. The most conspicuous of these is the one for the first endoturbinal plate. The septoturbinal surface is on a higher plane than that of the ethmoturbinals. The crista galli is distinct throughout. The non-perforate space is nearly one third the length of the cribriform plate. Of the nasal surfaces, it is seen on the frontal section that the divisions between the ectoturbinals and the endoturbinals are well defined. The former are seen to have a less complicated structure, and are arranged as converging radii from the upper and lateral walls. The endoturbinals are arranged in tiers, and constitute, with the median exposure of the nasoturbinal, the entirety of the median surface.

The ectoturbinals are nine in number. The first ectoturbinal and the nasoturbinal are confluent. The former presents a convex uniform surface above. The nasoturbinal is distinct from the meso-ethmoid. The second ectoturbinal is of the same size as the first, but more distinctly biconvolute at the base. The third is the longest of the ectoturbinal series, and reaches the centre of the ectoturbinal space. Three additional plates, rudimental in character, are seen on the lateral aspect of the section. The endoturbinals are also nine in number, four of them only reaching the median surface. They are much more convolute than in the ectoturbinals, and present a number of secondary folia.

The sphenoturbinal is seen distinctly united to the meso-ethmoid.

In the two-toed sloth,† *Cholœpus didactylus* (Plate III. figs. 5, 6), the cribriform plate is without angulation, as seen in the skull of the young of this species, and the entire surface which answers to that for endoturbinals is marked by four plates and associated foramina. The plates are all united anteriorly into a single transverse lamina. The posterior non-perforate space equals in longitudinal diameter one third of the area of the cribriform plate. The septoturbinal space is scarcely raised above the plane of the turbinal spaces. The crista galli answers in position to the anterior two-thirds of the same. No separate arrangement for ectoturbinals appears to exist. On the nasal surface the endoturbinals are, with the exception of the first, without lobes, and the nasoturbinal and the ectoturbinals are absent. The sphenoturbinal is united to the septum by three distinct laminæ.

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* For purposes of comparison, the encranial surface of the ethmoid bone of the hog is figured (Plate III. fig. 4), but not described.

† For purposes of comparison, the encranial and the nasal surfaces of *Bradypus* are presented in figs. 1 and 2 of Plate IV., but not here described.

In the *cat* * the nasal surfaces are much compressed medio-laterally. With the exercise of a little care, the parts can be analyzed without resorting to a transverse section. The first ectoturbinal is excessively short, and presents biconvolute folia directed upward. The second, third, and fourth ectoturbinals are slight, and are biconvolute their entire length. The plates and the convexities of the convolutions are distinctly visible on the lateral surface of the ethmoturbinal mass. The nasoturbinal is biconvolute, the median convolution being the larger anteriorly. The lobule of this turbinal is in height equal to one half the length of the nasoturbinal, and is crescentic in outline. The nasoturbinal and all the ectoturbinals are united anteriorly by a transverse lamina.

The endoturbinal plates are five in number. The first is the largest of the series. It is obscurely convolute, while the lobule is as long as the plate. It is obliquely placed from above downward, and before backward, lying in front of the second and third endoturbinals, and composed of a number of closely-set convolutions. It is the anterior division of Strauss-Durckheim. The second plate also possesses a distinct foliated lobe. The second and third plates are united on the lateral surface by a common lamina. The third plate is small, concealed from the median surface, without lobes, and partly concealed on the lateral surface by the above-named lamina. The fourth plate closely resembles the second. Its lobule is nearly the length of the plate. The fifth is without a lobe, and convolute medianly, the convex surface of this convolution appearing for its entire length on the free median surface of the ethmoturbinal mass.

In the seal, *Phoca vitulina* (Plate IV. figs. 3 – 5), the encranial surface presents a narrow septoturbinal surface. It lies on the same plane with that of the turbinal surfaces, extends over less than one third the width of the encranial surface, and terminates anteriorly by an enormous foramen. The rounded surface answering to the ectoturbinal space is bordered by an elliptical row of foramina. The ridges for the endoturbinals are inconspicuous and short, not extending, even for the first endoturbinal, more than one third of the diameter of the cribriform plate.

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* Elaborate figures of the ethmoid of the *cat* are contained in the work of Strauss-Durckheim, *loc. cit.*

The crista galli is robust, and extends the entire length of the cribriform. The non-perforate space is one third as long as the cribriform, thus presenting a striking contrast with the same plate of the other Carnivora mentioned in this paper. It is concealed in part by the frontal bone in articulation of the bone with the cranium, but in the disarticulated bone it is convex or rounded in outline and nearly equal to the ectoturbinal surface in diameter. From it the ectoturbinal plates in part arise. These last-named plates, with their accompanying convolutions, are well seen on the lateral surface.

As in the *dog*, the *cat*, the *otter*, and other carnivores, the nasoturbinal, as in the *seal* in part, arises from the meso-ethmoid. It is held to the meso-ethmoid one half the length of the latter, at its upper margin. The union does not interfere with free access of air to the olfactory plates.

Huxley makes a statement, in his "Anatomy of the Vertebrated Animals," to the effect that the ethmoturbinals in the seal are small and flattened, and that the latter are *anchylosed with the vomer on each side.* In a single specimen examined I did not find this to be the case. (See Plate IV. fig. 3. The position of the arrow indicates the septoturbinal space.) It is true that the mass is, on the whole, flattened ; but the frontal portion of the mass is more than usually well developed, and at no point did anchylosis exist. The remarkably thickened transverse lamina was probably in this statement mistaken for an exceptional layer of union.

In the star-nosed mole, *Condylura cristata*, the ectoturbinals advance forward as far as the anterior end of the transverse lamina. The nasoturbinal extends as far as the third premolar. The first endoturbinal reaches to the last premolar ; the second and third are of nearly equal size ; all the endoturbinals presenting uniformly broad contiguous median surfaces, the first and third not connected below the cribriform plate. In transverse section the ectoturbinals are seen to be four in number, the last being the largest. It would here seem that the last is the one retained in the Cheiroptera.

THE ETHMOID BONE IN THE CHEIROPTERA.*

Enough has been said, I trust, of the general plan of arrangement of the several parts in the ethmoid bone of mammals, to serve as an introduction to the description of the bone in the Cheiroptera. It was, indeed, in attempting to describe the bone as found in the bats that the necessity of a revision of the subject became evident. It is not to be inferred from this statement that the ethmoid bone in the bats differs in any essential feature from the bone as above described. In the more generalized forms, as the Pteropines and in most of the Phyllostomines, the ethmoid, while simple in construction, is in general appearance much the same as in other mammals. But in the more specialized genera, the details are so strongly contrasted with those of the mammalian type, (presenting a number of characters, which it is thought may be of value in classification,) that the special attention of the reader is invited to their consideration.

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* The crania furnishing the basis of this study were, with few exceptions, furnished by the Museum of Comparative Zoölogy.

Descriptions of the Ethmoid Bone, including all its Parts.

Pteropus medius. — The encranial surface presents a small ectoturbinal space, which, however, is as wide as the union of the septoturbinal and endoturbinal spaces farther backward. The cribriform is thus narrowed, and without conspicuous ridges or other markings than the median and lateral rows of foramina. The non-perforate surface is a mere narrow rim.

The ethmoturbinal mass is much compressed laterally, and composed of a single ectoturbinal and a series of four endoturbinal plates, which are united anteriorly and laterally. The tendency for the endoturbinal plates to form parts of one functional surface recalls the disposition of the parts in the Quadrumana. The opening above the endoturbinal series is distinctly median. The first plate lateral to this opening would be the nasoturbinal, which here does not appear to be different from the usual disposition of an ectoturbinal, and I have concluded so to name it.

The ectoturbinal extends as far as the plane of the anterior border of the first molar. It is higher at its origin from the cribriform plate than at its anterior free end. It is curvilinear and convolute outward. It is attached its entire length to the lateral surface of the ethmoturbinal mass, and anteriorly to the endoturbinal transverse lamina.

The endoturbinal series of plates are united by a broad transverse lamina, which anteriorly (i. e. beyond the point of its union with the vomer) is deeply concave on its free under surface, so as to cover in the maxilloturbinal.

In a profile view of the median surface of the ethmoturbinal series the vertical aspect of this concave surface is distinctly seen, and closely resembles a lobe; but it is not traceable to any one olfactory plate. The transverse lamina is traceable backward to the anterior ends of all the olfactory plates, including the ectoturbinal. The lower anterior half of the median surface of the plate is emarginate. The anterior end of the lamina reaches as far as the canine tooth. Of the endoturbinal plates themselves it may be said that the first endoturbinal plate is nearly simple, and reaches the transverse lamina at the plane of the anterior border of the first molar. The second endoturbinal plate arises in common with the preceding, and ends at the same point. It is biconvolute. The third plate reaches as far as a point between the first and second molars. It is convolute, but permits a small portion of the plate to be seen anteriorly.

Cyonycteris. — The general plan of the plates is the same as in *Pteropus.* The median vertical aspect of the concavity of the transverse lamina is one fourth the length of the second endoturbinal plate. The anterior margin is concave.

Epomophorus gambianus (Plate V. fig. 1). — The general plan of the plates as in *Pteropus.* The produced end of the transverse lamina reaches the plane of the anterior edge of the second premolar.

Cyanopteris. — The general plan of the plates as in *Pteropus.* The anterior margin of the median vertical aspect of the transverse lamina is straight (that is, not concave), and less oblique than in *Pteropus.*

Phyllorhina tridens (Plate VI. fig. 5). — The olfactory plates two in number. They are apparently the first and second endoturbinals. Each plate ends anteriorly in a clavate median process or lobe. The two are separate from each other, and nearly vertical in position. The encranial surface is of extreme simplicity.

Rhinolophus ferro-equinum (Plate VI. fig. 4). — The first ectoturbinal arched, long, reaching as far as the plane of the anterior border of the first molar. The first and second endoturbinals are horizontal, simple, not contiguous. They are without lobes, and are non-convolute. They do not advance beyond the vomerine portion of the transverse lamina. The encranial surface is slightly inflated over the cribriform plate. The ectoturbinal space is absent. The non-perforate space is scarcely at all raised.

Megaderma frons (Plate VI. fig. 2). — The ectoturbinal absent. The endoturbinals two in number, as in *Phyllorhina* and *Rhinolophus.* Both of these possess small swollen lobes, but are both confined within the limits of the vomerine portion of the transverse lamina. The lobes, as they appear on the median surface, are nearly vertical. Projecting in advance of the plates as far as the level of the last premolar is a lobule, which may be said to represent the produced transverse lamina, although in this genus it more closely resembles a septum defining the outer wall of the nasal chamber. The encranial surfaces were not examined.

Megaderma spasma (Plate VI. fig. 1). — The ectoturbinal a minute tubercle, lying above and to outer side of first endoturbinal. The ethmoturbinals four in number. The first endoturbinal is separated by a short interval from the remaining two. It is but slightly lobulated, extends as far as the level of the anterior border of the second molar, and is obliquely placed from above downward and from behind forward. The second and third endoturbinals are parallel, nearly contiguous, the second scarcely exceeding the third in length. The first is lobed for one third its length.

Nycteris thebaica (Plate VI. fig. 3). — The plates are three in number, one ectoturbinal and two endoturbinal. The first of these answers in position to the nasoturbinal, since it bounds posteriorly the opening leading outward from the nasal chamber. Its frontal surface is furnished with a clavate swelling, which is slightly projected as a small lobe. The first and second endoturbinals are smaller than the nasoturbinal, and are so arranged as to permit the second to conceal the third. The latter is, indeed, the only one of the two seen in profile, the former lying between it and the nasoturbinal. The first endoturbinal is slender pedunculated, and bears a small bifid lobule. The second endoturbinal is almost as stout as the nasoturbinal, and its lobule projects forward for a distance equalling one half of the plate itself. The lobe is obscurely clavate.

In the Vespertilionidæ the arrangement of the plates is more simple than in the Pteropidæ, but more complex than in *Rhinolophus* and the allied genera.

Vesperus. — The openings of the septoturbinal space are confined to a large foramen placed just in advance of the non-perforate space. Near to the septum, at the anterior portion of the space, is seen a group of foramina advancing well to the front. Directly opposite the beginning of this series to the lateral side is the group of foramina for the first endoturbinal plate, while in front of the latter lie the two foramina for the single ectoturbinal plate. The arrangement is the same in *Vesperugo.*

Seen from the nasal aspect in *Vesperus noctula*, the ectoturbinal is two thirds the length of the first endoturbinal. It is thickened above and convolute laterally at the summit. The lateral surface is concave. The entire plate rests on the concave lateral surface of the first endoturbinal. The last-named plate is very broad above, and expands laterally and in front of the ectoturbinal. It is narrower at the base than at the tip, where it is prolonged slightly along the median border into a slender process. The lateral border of the portion in advance of the transverse lamina extends as far as the anterior edge of the second premolar. It is concave to receive the convex maxilloturbinal. The second endoturbinal is slightly narrower behind than in front. It is twice the size of the third endoturbinal, which is subrounded.

Vesperus fuscus. — The ectoturbinal is as in *V. noctula*, with the exception that it is deflected a little more outward. The first endoturbinal is acuminate, with a uniformly sloping border. On the median surface the plate is not visible below the second and third plates. The second plate is as in *V. noctula.* The third is longer than wide.

Scotophilus Temmincti. — The ectoturbinal is compressed medio-laterally, without lateral concavity, and is deflected slightly outward. It is a little more than one half the length of the first endoturbinal. The latter plate is much as in *V. noctula.* Its lateral border extends a short distance beyond the ectoturbinal. The end of the free portion is a narrow point, and lies at the level of the premolar. The median surface bears a general resemblance to the same part in *V. noctula.*

Vespertilio (Plate VII. fig. 6). — The encranial surface in all essential features as in *Vesperus.* The single ectoturbinal one third the length of the first endoturbinal plate. As seen from above, the ectoturbinal is lodged in a concavity in the lateral surface of the preceding plate. The first endoturbinal is produced as far as the first premolar. The plate is of a pyriform figure as seen from above, and presents a truncate apex. The portion in advance of the transverse lamina is deeply concave below, and overlies the maxilloturbinal. The second endoturbinal is of a triangular figure, with a rounded apex. It appears to be lodged, when the parts are viewed superficially, on the median surface of the endoturbinal series. The third endoturbinal is the smallest of the three, and is continuous with the upper portion of the first endoturbinal.

All the preceding genera of the Vespertilionidæ, as contrasted with the genus next to be mentioned, have the first and third endoturbinal plates united above the second plate.

Atalapha. — In *A. noveboracensis* the encranial surface presents the septoturbinal foramina placed in a row along the anterior half of the space of the same name. The openings of the ectoturbinal surface are in a direct line with the foregoing, and both are depressed below the general surface. The foramen for the first endoturbinal is seen lying at the bottom of the conspicuous depression near the crista galli. The foramina are everywhere at the sides of the encranial surface. Seen from the nasal aspect the ectoturbinal seems to be nearly the length of the first endoturbinal, and is compressed medio-laterally. It is slightly convolute outward at its base, and concave on its lateral surface. The first endoturbinal is abruptly acuminate anteriorly, and straight on its median, lateral, and under free surfaces, the last named being concave inferiorly. The second endoturbinal plate is oblique, and slightly inflated at its anterior end. Its lower border forms the inferior edge of the median series of plates. The third endoturbinal is triangular in shape, and is one half the size of the preceding.

In *A. cinereus* the general plan resembles that of the foregoing species. The parts are, however, of greater height, the interval between the first and second endoturbinals being wider. The second endoturbinal is relatively larger, and curved outward. This arrangement causes the plate to present a concave surface outward, which receives the swollen lower border of the third plate. The median aspect of the first endoturbinal is straight; but the lateral surface is deflected outward, and is impressed on its entire surface by the ectoturbinal which rests upon it, leaving only a raised rim of the endoturbinal round its anterior half. The median surface of the produced portion of the first endoturbinal is nearly as high as it is long. The concave under surface embraces securely the maxilloturbinal.

Nycticejus crepuscularis. — In this genus the encranial surface is about one third the area of the entire region, the cribriform plate marked as follows: first, a single opening is seen on the sphenoturbinal surface; second, two openings on the ectoturbinal surface; third, a relatively large depression on the endoturbinal, containing two openings, well to the lateral aspect, for the first endoturbinal plate.

The nasal surface exhibits a single ectoturbinal plate. It is a little less than one half the length of the first endoturbinal, is directed almost vertically downward, the swollen upper border looking outward. The lateral surface is concave, deflected outward as far as the tip of the first endoturbinal. It is slightly concave above. The free portion is acuminate, reaching as far as the level of the canine tooth. The second plate is as in *V. fuscus*, but not so much narrowed at the base. The third is a mere rounded nodule.

Lasionycteris noctivagans. — The septoturbinal space extends a little in advance of the septal line. There is but a single opening for the ectoturbinal. The main plate is marked by a relatively small opening, behind which extends a row of three small foramina. The non-perforate space is as in the preceding forms. On the nasal surface the endoturbinal series is inflated, and does not exhibit the lateral concavity seen in other

Vespertilionidæ. It is directed downward and forward. The first endoturbinal is as in *V. fuscus.* It reaches a point as far as the canine tooth, is slightly depressed above, and presents a uniformly sloping surface laterally. Its lower edge forms the lower border of the median surface. The second endoturbinal is of uniform width, longer than high, and equal in length to the free portion of the first endoturbinal. The third endoturbinal is smaller than the preceding.

Antrozous pallidus. — The ethmoid bone in this genus closely resembles that of other Vespertilionidæ. The ectoturbinal is compressed medio-laterally.

Mollosus obscurus. — The ectoturbinal is biconvolute, slightly acuminate in front, and subequal in length to the mesoturbinal. The endoturbinal is somewhat broader in front than behind, straight on its median surface, concave on its lateral surface to receive in a measure the ectoturbinal. It is apparently without an olfactory plate, which being understood to be present the entire endoturbinal forms a summit thereto with two convolutions which make up the median and lateral surfaces respectively. The concavity thus opening downward receives in part the maxilloturbinal. The second endoturbinal is absent. The third and fourth closely resemble the same plates in the Phyllostomididæ, and do not demand any special description. The transverse lamina is apparently absent.

M. perotis. — The ectoturbinal is compressed from side to side, and is one half the length of the first endoturbinal. The first endoturbinal is acuminate as it is seen from the median surface, the portion projecting in advance of the third endoturbinal being slightly convex inferiorly. The third endoturbinal is received in a depression on the lateral surface of the first, the second being absent. It in turn receives the fourth. Both these turbinals as seen *in situ* are longer than wide.

Natalus stramineus. — The ectoturbinal is absent. The second is slender and acuminate, the convolutions uniting inferiorly at the anterior two-thirds. The lower border of the free part is straight. The third endoturbinal is globose, and one third the length of free portion of the preceding. The fourth is exceedingly minute, being about one third the length of the third. It is somewhat rounded in form.

Taphozous (Plate VII. figs. 2, 4). — The ectoturbinal somewhat broader than the first endoturbinal, but of the same length. The transverse lamina deeply concave, completely concealing the small maxilloturbinal. The under portion of the free portion of the first endoturbinal is traceable as far back as the end of the endoturbinal series. The median aspect of the concavity not projected, as in most genera, but appears as a rounded convexity of equal width with the exposed portions of the endoturbinals. The second endoturbinal appears as a nodule between the transverse lamina and the second endoturbinal; the third and fourth much as in other genera, the lower border of the third plate being visible from the lower edge of the series.

Rhynconycteris naso. — The ectoturbinal absent. The remaining three endoturbinals closely resemble one another. The first projects in advance beyond the third no more than the third projects beyond the fifth. The free portion of the first small, yet reaches the level of the anterior of the second premolar. The plates on the median surface while contiguous leave exposed a larger surface than is the case in any other genus of the Molossi.

Noctilio leporinus (Plate VII. fig. 5). — The ectoturbinal inflated nearly twice the thickness of the first endoturbinal, and nearly equalling it in length. The median aspect of ethmoturbinal closely resembling Molossus. The free portion of each plate of about equal width. The nasoturbinal of great width anteriorly, and almost entirely concealing the maxilloturbinal.

Mormops megaphylla. — The encranial surface presents the following features. The single ectoturbinal foramen is small. That for the first endoturbinal is conspicuous. The extent of the non-perforate space appears to be enormous as compared with the same space in other genera. The ectoturbinal is a mere rounded point at the base of the first endoturbinal. The endoturbinal series closely resembles the same in the Vespertilionidæ. The first endoturbinal is without the lobe present in *Chilonycteris.* Its under surface is concave at the free produced portion, and conceals the unusually long maxilloturbinal. The second ethmoturbinal is very slender and oblique. It is continuous above with the first thus differing from the arrangements seen in Vespertilionidæ. The third plate is obscure, if not absent. It is apparently continuous with the crista galli.

Chilonycteris rubiginosa. — The first ectoturbinal subglobose, one fourth the length of the first endoturbinal. The free projecting portion of the first endoturbinal is deeply concave beneath, and completely covers in the maxilloturbinal, as in the Vespertilionidæ. It reaches as far as the first premolar. This plate bears upon its summit a lobule, as in the Phyllostomididæ. The second and third endoturbinals are simple, non-revolute, nearly vertical, the third being the broader.

Desmodus rufus (Plate VII. fig. 1). — The ectoturbinal is inflated, and nearly the length of the first endoturbinal. The first endoturbinal is compressed, and reaches the plane of the anterior border of the single molar. A lobule in the position of the basal convolution of other Phyllostomines lies between the first and the third plates, and resembles in general appearance a separate endoturbinal. The second endoturbinal is small and concealed. The third and fourth plates are in general appearance much as in other Phyllostomines. The lobes of the first and third endoturbinals are conspicuous.

Carollia brevicauda (Plate V. figs. 3, 5). — The first ectoturbinal is inflated, with no trace of the concavity marking the plate in the Vespertilionidae. It is two thirds the length of the first endoturbinal. The last-named plate is narrowed anteriorly, but not acuminate, since the tip is truncate. Its lower border is concave. The lobule at the summit of the plate is broader in front than behind, and equals the free portion in length. The third plate is concealed. The fourth is of the same size and shape as the foregoing. The fifth is triangular in form, open beneath, and presents the appearance of having a large lateral convolution equal in length with the main plate. The maxilloturbinal is rudimentary and free from the ethmoturbinal.

Lonchoglossa. — The general plan in this genus is as in other Phyllostomines. The ectoturbinal is minute, compressed, not more than one half the length of the first endoturbinal. The latter is thin, straight, with a long falciform lobe, which is concave inferiorly. The basal lobule is well developed, and lies at the lower border of the median surface of the ethmoturbinal. The remaining endoturbinals as in other Phyllostomines, but less obliquely inclined.

Phyllostoma hastatum (Plate V. fig. 2). — The foramina of the septoturbinal and the ectoturbinal surfaces on the encranial aspect form a continuous arch. The depression for the main plate is large, and the space behind it is occupied by numerous openings arranged without apparent order.

Schizostoma. — The ectoturbinal is moderately inflated, but less so proportionally than in *Dermanura.* The narrow and acuminate first endoturbinal projects about one third of the length of the ectoturbinal. Its lobule is inconspicuous. The second endoturbinal is concealed, and presents a slightly inflated upper border. The third plate possesses a large anterior lobule, which is convex forward. The parts are contiguous upon the median surface.

Macrotus Waterhousii. —The ectoturbinal is small, a little less than one half the length of the first endoturbinal. Its upper border is horizontal, and its lower concave. The extreme tip of the lobule extends as far as the anterior border of the first molar. The second plate is concealed, and the third and fourth are arranged much as in *Vampyrops*, which this form in great part resembles. The lobule on the first endoturbinal is small, but readily discernible. The plates below their inflated summits are not clearly seen. The parts on the median surface are contiguous.

Vampyrops. — The ectoturbinal extends the entire length of the inner wall of the orbit, and is inflated. The first endoturbinal is concealed between the last named and the second endoturbinal. It is a simple inflated plate, without convolutions. It is in intimate association with the region of the second plate, with which it may be confounded. If the first endoturbinal plate be counted as a lobule upon the base of the second, the series will lack the number five which all other genera of this group possess. Assuming, therefore, that the concealed plate is the true second endoturbinal, the one below it becomes the third. The last-named third plate is the largest of the series, and resembles the second of the *Pteroderma* related forms. It is broad, non-convolute, and ends in a narrow tongue that reaches a point as far forward as the anterior border of the first molar tooth. The fourth endoturbinal is a nearly simple plate, having a thickened free upper border. Its free surface is entirely median, and almost linear. The fifth endoturbinal is exposed on the median surface for its entire extent; its anterior border is thickened, and convolute upwards. The frontal section of the ethmoturbinal presents the ectoturbinal and the first endoturbinal in close juxtaposition and assuming a medio-lateral relation, while the remaining plates are arranged nearly at right angles to them. There appear to be no plates comparable to the sphenoturbinals.

Pteroderma (Plate V. fig. 6). — The ectoturbinal of a triangular form, whose base is forward and advances as far as the ends of the olfactory plates of the endoturbinals minus the lobules, and nearly to the hinder border of the orifice of the maxillary sinus.

The first endoturbinal is convolute laterally, and possesses an acuminate lobe directed forward that equals the plate itself in length. The free end of the olfactory plate is distinctly seen beneath the level of the lobe. Lying at the level of the lobe just described, behind the free portion of the plate, is a small nodule, which may receive the name of the *posterior lobe*, as opposed to the preceding, which is as compared to this an anterior lobe. The second endoturbinal plate is free inferiorly, but is biconvolute above for the greater part of its length. The last-named portions are concealed by the lobes of the adjacent plates. The third endoturbinal plate is free beneath, and possesses a broad fleshy lobe directed forward. The fourth plate, unlike the preceding, is not free at its base beneath, and is the smallest of the series. It presents a concave border in front, and is furnished with a fleshy lobe which is directed backward. The surfaces of all the olfactory plates are separated by appreciable intervals.

Artibeus (Plate V. figs. 4, 6). — The parts in this genus closely resemble those of *Pteroderma*. The ectoturbinal is exceeding slender, and is furnished with a fleshy summit, which is convolute outward. Its upper portion alone is seen from the median surface. The first endoturbinal is free below, but fleshy above. It is produced forward one half its length beyond the end of the ectoturbinal in the form of a lobule, is acuminate, and possesses as in *Dermanura* a small posterior lobe. The second endoturbinal is concealed by the third. When the latter is pressed aside at its upper part the small biconvolute plate of the second plate is seen in position. The third endoturbinal possesses a large lobule, which lies upon the median surface. The lobule is subrounded in form, completely occupying the upper edge of the plate, so that it appears to arise from the cribriform plate by a pedicle. The fourth endoturbinal presents an exposed plate on the median surface. It is beneath the convex non-perforate space, and yields a single large convolution, which is turned outward. Although this plate lies back of the cribriform plate, the absence of any connection between it and the vomer would seem to show that the arrangement met with in many mammals is departed from.

Dermanura. — In this genus the ectoturbinal is inflated, and is projected beyond the first endoturbinal one half its length. The first endoturbinal is concave outward, is without a lobule, and in a measure embraces the last-named plate. The remaining plates are arranged as in *Pteroderma*. On the encranial surface the depression for the main plate is without associated foramina, but in their stead three openings are seen, ranged transversely. The ectoturbinal opening is single.

THE PHYSIOLOGICAL ANATOMY OF THE OLFACTORY SENSE IN THE MAMMALIA.

The olfactory organ in the mammalia is an appendage to the respiratory tract. It depends upon the direct contact of the odoriferous particle upon the specific cell fixed upon the olfactory surface, and united with a terminal filament of an olfactory nerve. The olfactory plates upon which the cells lie are composed of two sets, an ectoturbinal and an endoturbinal, the space between them being defined on the median aspect by the nasoturbinal. In advance and beneath these plates, as well as being more or less embraced by the endoturbinals, the maxilloturbinal lies.* This bone acts as a sieve to warm the current of air entering the olfactory region, and to exclude extraneous particles. The particles which pass through the upper half of the maxilloturbinal pass directly to the ectoturbinals and the plates of the endoturbinals for the distance from their lateral attachments to the primary terminal convolutions or endings. The current passing through the lower half of the maxilloturbinal is received within the space below the level of the ethmoturbinal, and is chiefly respiratory. A large opening exists between the nasal chamber and the superior maxillary sinus, partly within which the ectoturbinal plates lie. The lower current may be deflected in part laterally through this opening or drawn upward between the lobes of the endoturbinal plates. Direct contact of the inspiratory currents through the space between the maxilloturbinal and the septum must be inconsiderable, by reason of the close relation, if not contact, existing between these parts. A small passage between the nasoturbinal and the septum would permit some to pass. It will be seen that all the currents above indicated are directed immediately inward, or inward and upward. In these directions no continuity with the air-passage exists. The currents in time must impinge upon the sides and roof of the nasal chamber above the level of the transverse lamina, and lie against the cribriform plate. Within this restricted area the currents may be assumed to cease, and their odor-bearing particles to fall gently upon the olfactory surfaces. This condition of rest doubtless goes on while ordinary respiration continues. So it is conceivable for a gentle respiratory current to be passing in and out along the lower portion of the nasal chamber, while the air is at rest unloading itself of its odoriferous particles above the transverse lamina. When the air is sniffed, the invitation for its ascent into the olfactory chambers is marked, — an act probably accompanied by partial elevation of the soft palate, by which means the respiratory current through the nose is suspended, and the air compelled to ascend to the olfactory level. The transverse lamina, therefore, has great functional significance. The parts contained above this lamina would appear to have the most strongly localized olfactory signifiance, and the projected parts or lobes to be in part protectors of the maxilloturbinals, or highly specialized portions of the olfactory apparatus, in animals remarkably endowed with the sense of smell.*

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* The maxilloturbinal is continuous forward through the means of a well-defined crest into the snout, where it ends in the prominent swelling at the upper lateral border. Near its end it is concave outward, the concavity receiving a little crest-like fold on the outer side of the snout. The above description applies to the parts as seen in *V. noctula*, but is probably true of all mammals.

CONCLUSIONS.

From the foregoing statements it is evident that the ethmoid bone varies greatly in its details in the Mammalia. While these variations may not have yielded any clews to relationship of genera in addition to those already entertained, they may nevertheless be said to present new evidence by which old claims can be strengthened. It has been seen that generalized forms, such as *Sus*, *Equus*, or *Dicotyles*, are related to more specialized forms, such as *Bos* or *Ovis*, not only by the characters yielded by the foot, the teeth, and the placenta, but by the ethmoturbinal bones as well. In like manner, in a generalized genus of the Carnivora, as *Ursus* or *Procyon*, the ethmoturbinal bones possess a less degree of specialization than in *Felix* in one direction, and in *Phoca* in another. If the testimony in confirmation of such relations of these genera were lost, it could be restated from the data obtainable from a study of the ethmoidal plates. — In the *bats* a plan similar to the one existing in the majority of the mammals is recognized in the Pteropidæ and Phyllostomididæ (groups already known to be generalized), but which is strangely departed from in highly specialized forms, as the Megadermatidæ and the Rhinolophidæ, and in a widely different way in the Vespertilionidæ. — It has been found that in many of the Cheiroptera, generic and even specific characters can be found in the ethmoid bone; and, on the whole, it is temperate to affirm that a comprehensive account of any species of *bat* would be imperfect which omitted an account of this bone. It is probable that a similar statement might with propriety be made for all mammals. Certainly it may be said that, in the study of those genera of whose affinities the zoölogist remains in doubt, a careful examination of the ethmoid bone should be made. — Much might be said of the relation existing between the size of the olfactory bulb and the degree of development attained by the ethmoturbinal plates, — the bulbs, as has been found, being well developed in animals having large ethmoturbinals, and being small in others having small endoturbinals, — and of the mechanism of the act of smelling, and the significance, in a word, of the function of smelling in connection with habit. But any such extended discussion would be out of place in a communication planned as this has been, and would in no way strengthen the proposition which it was the original object of the paper to demonstrate.*

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* The relation borne by the ectoturbinals to the frontal sinus, by the sphenoturbinals to the sphenoidal sinuses, and by the passages of access to the lateral part of the ethmoturbinals to the maxillary sinuses, suggests the probability that the primary signification of these chambers is to accommodate the olfactory plates; and that in the human subject, where they are empty and not held subservient to the sense of smelling, the original conception has been lost, owing to the stunted condition of the olfactory apparatus. Until elaborate studies of the development of the mammalian head are instituted with the object of confirming such a suggestion, but little can be said about it in this connection. It must be remarked that the labors of Kitchen Parker (*loc. cit.*) have not led to any affirmative answer to such a line of inquiry.

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* I may here add, that a careful microscopic study of the cells of the olfactory plates, and a comparative study of the olfactory sense, and the tactile sense of bats as developed in the external nasal appendages, yielded at the hands of my friend, Dr. Francis X. Dercum, a negative result. The forms that were taken for study were *Phyllostoma hastatum* and *Nycteris Thebaica.*

EXPLANATION OF THE ABBREVIATIONS EMPLOYED IN DESCRIBING THE FIGURES.

m. t.	Maxilloturbinal.
n. t.	Nasoturbinal.
tr. l.	Transverse lamina.
ect. t.	Ectoturbinal.
end. t.	Endoturbinal.
ect. sp.	Ectoturbinal space.
end. sp.	Endoturbinal space.
s. t. sp.	Septoturbinal space.
m. e.	Meso-ethmoid.
sp. t.	Septoturbinal.
fr.	Frontal.
op. f.	Optic foramen.
cr. gl.	Crista galli.
orb.sph.	Orbitosphenoid.
n. p. s.	Non-perforate space.
l.	Lobule.
ol. pl.	Olfactory plate.
orb. pl.	Orbital plate.

EXPLANATION OF FIGURES.

PLATE I.

Fig. 1. Sagittal section of head of the dog, showing the oblique position of the encranial surface of the ethmoid bone, with the median aspect of the lateral mass of the same bone. A portion of the septum has been included in the section at the transverse lamina. The horizontal line between the asterisks represents the dividing line between the olfactory and the respiratory regions of the nasal chamber. — It is probable that some variation will be found to exist in the turbinals of the domestic dog. Natural size.

Fig. 2. Frontal section of the nasal chamber of the dog, a short distance in advance of the encranial surface. Natural size.

Fig. 3. Diagrammatic representation of the encranial surface of the dog. Natural size.

Fig. 4. Encranial surface of the otter. Natural size.

Fig. 5. Diagrammatic frontal section of the turbinals of the otter. Natural size.

PLATE II.

Fig. 1. Median surface of lateral mass of ethmoid bone of *Cebus capuccinus.* Natural size.

Fig. 2. The under surface of same. Natural size.

Fig. 3. The under surface of lateral mass of the human ethmoid bone. Natural size.

Fig. 4. The encranial surface of the ethmoid bone of the horse. The dotted line, as it extends across the surface, represents the lower limit of the plate of bone described in the text as covering in the ectoturbinal subdivision of the surface. Natural size.

Fig. 5. Frontal section, diagrammatically treated, of the turbinals of the horse. Natural size.

PLATE III.

Fig. 1. Encranial surface of the ethmoid bone of the peccary. Natural size.

Fig. 2. The isolated ridge of the first endoturbinal plate. Natural size.

Fig. 3. Frontal section of turbinals of same, made close to the encranial surface. Natural size.

Fig. 4. The encranial surface of the ethmoid bone of the hog.

Fig. 5. The under nasal surface of the ethmoid bone of the two-toed sloth (*Cholœpus didactylus*). Natural size.

Fig. 6. The encranial surface of the same. Natural size.

PLATE IV.

Fig. 1. The anterior aspect of the ethmoturbinals of the ethmoid bone of the three-toed sloth (*Bradypus tridactylus*).

Fig. 2. The encranial surface of the same.

Fig. 3. The ethmoid bone of the common seal (*Phoca vitulina*).

Fig. 4. The encranial surface of the same.

Fig. 5. The under surface of the same.

The figures are all of natural size.

PLATE V.

Fig. 1. Median sagittal section of nasal chamber of *Epomophorus gambianus*. Slightly enlarged.

Fig. 2. The same of *Phyllostoma hastatum*.

Fig. 3. The same of *Carollia brevicauda*.

Fig. 4. The same of *Artibeus* (slightly distorted).

Fig. 5. Dorsal aspect of the turbinals in *Carollia brevicauda*.

Fig. 6. The sagittal section of nasal chamber of *Pteroderma* (slightly distorted).

Fig. 7. The dorsal aspect of turbinals of *Artibeus*.

Figs. 2–7 enlarged one half.

PLATE VI.

Fig. 1. A median sagittal section of the nasal chamber of *Megaderma spasma*.

Fig. 2. The same of *Megaderma frons*.

Fig. 3. The same of *Nycteris Thebaica*.

Fig. 4. The same of *Rhinolophus ferrum-equinum*.

Fig. 5. The same of *Phyllorhina tridens*.

Figures enlarged one half.

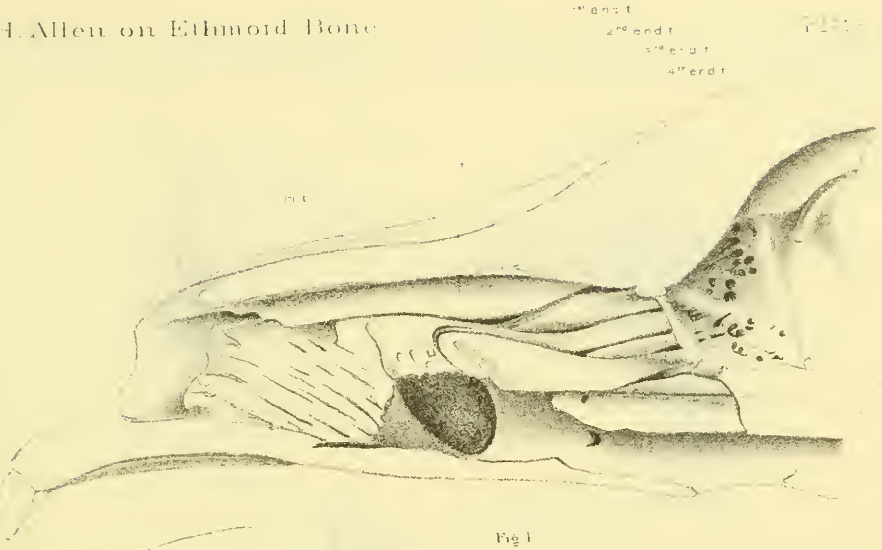
PLATE VII.

Fig. 1. A median sagittal section of the nasal chamber of *Desmodus rufus.* Figure enlarged two thirds.
Fig. 2. The same of *Taphozous.*
Fig. 3. The dorsal aspect of the turbinals of *Vespertilio subulatus.*
Fig. 4. The same of *Taphozous.*
Fig. 5. A median sagittal section of the nasal chamber of *Noctilio leporinus* (somewhat distorted, the nasoturbinal elevated).
Fig. 6. The same of *Vespertilio subulatus* (somewhat distorted, the first endoturbinal elevated).

Figs. 2–6 enlaged one half.

Philadelphia, November 4, 1882.

H. Allen on Ethmoid Bone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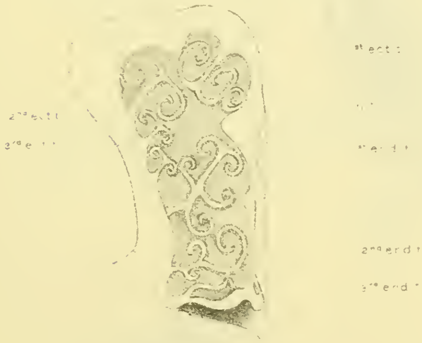
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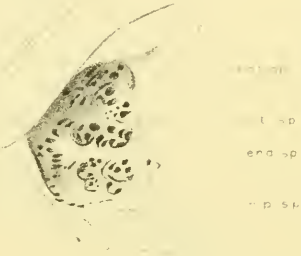
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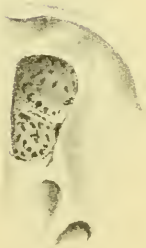

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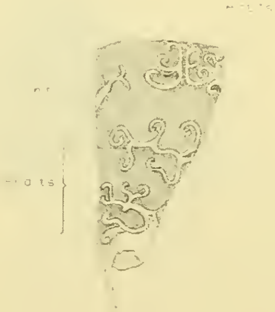

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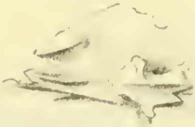
H Allen on Ethmoid Bone



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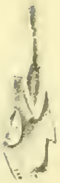

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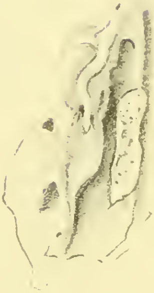

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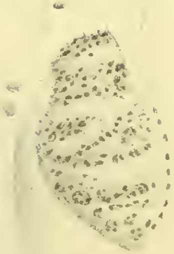

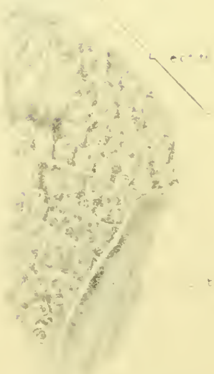

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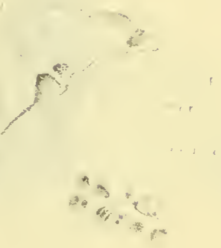

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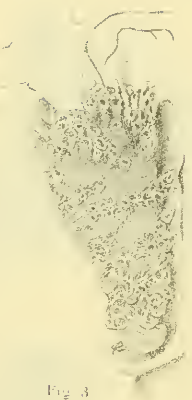

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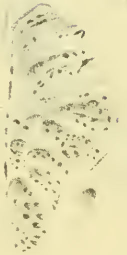

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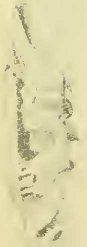

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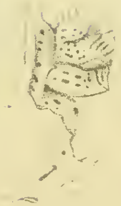

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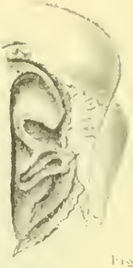

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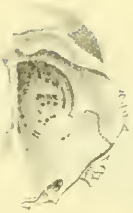

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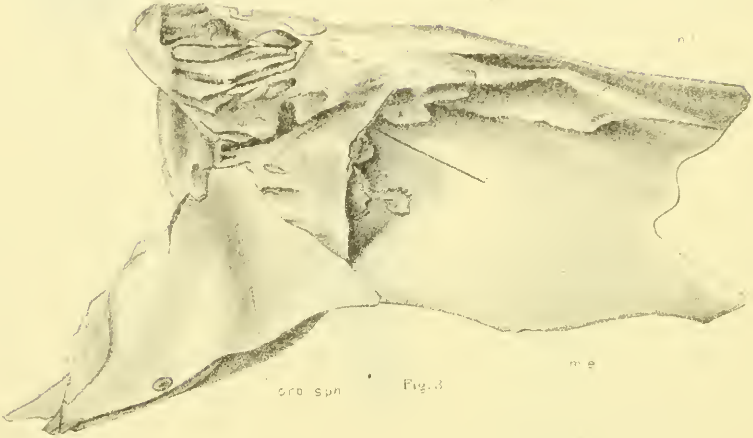

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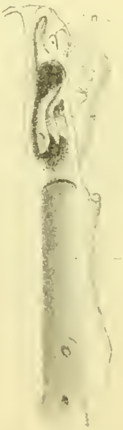

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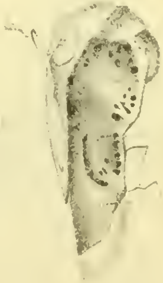

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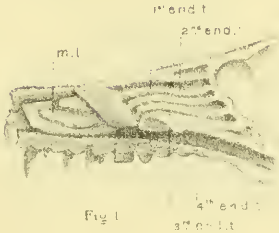
E. J. Nolan del.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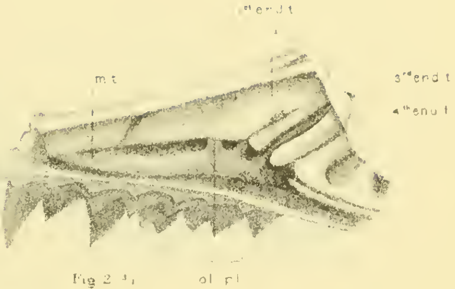
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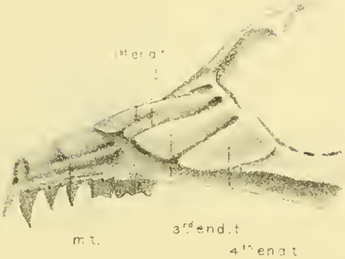
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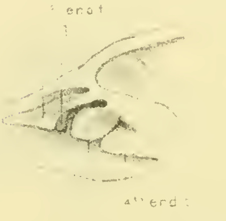
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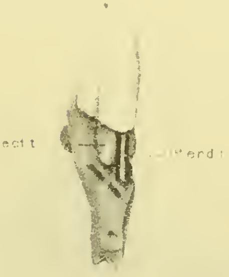
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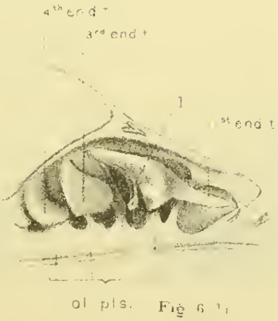
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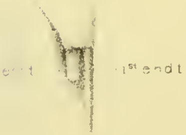
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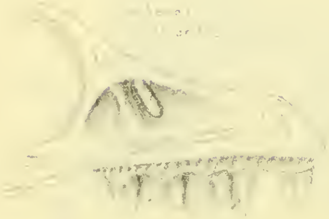
Fig. 7

E. J. Nolan, del.

Fig. 1



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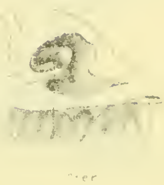

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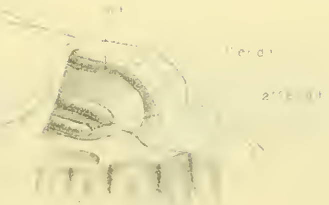

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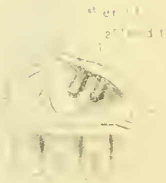

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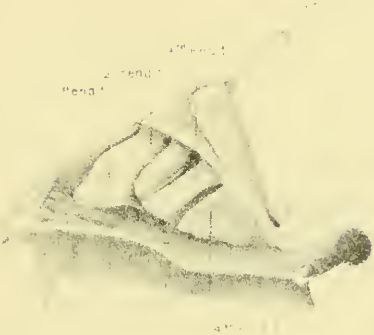
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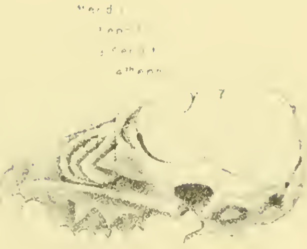
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2nd end.t
3rd end.t
4th end.t
y
7

Fig 2

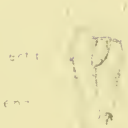

Fig 3

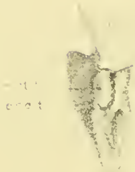

Fig 4

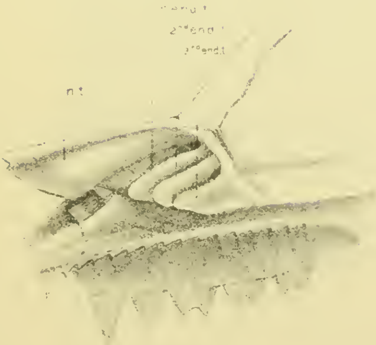
1st end.t
2nd end.t
3rd end.t
nt

Fig 5

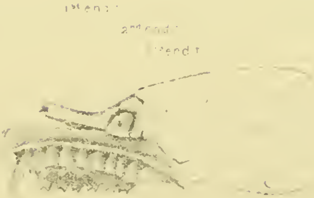
1st end.t
2nd end.t
3rd end.t

Fig 6

E. J. Nolan del.

No. 4. — *Reports on the Results of Dredging under the Supervision of* Alexander Agassiz, *in the Gulf of Mexico* (1877–78), *and in the Caribbean Sea* (1878–79), *by the U. S. Coast Survey Steamer "Blake,"* Lieut.-Commander C. D. Sigsbee, U. S. N., *and* Commander J. R. Bartlett, U. S. N., *Commanding.*

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XVIII.

The Stalked Crinoids of the Caribbean Sea. By P. Herbert Carpenter.

Owing to the lamented death of the late Sir Wyville Thomson, it has become my duty to complete the Report upon the Stalked Crinoids of the "Challenger" Expedition, which had been commenced by him. It had been arranged between Sir Wyville and Mr. Agassiz that the descriptions of the species obtained by the "Blake" in the Caribbean Sea should be incorporated in the "Challenger" report, which would thus assume the character of a Monograph of nearly all the known species of the group.* For this purpose nearly thirty plates were drawn at Edinburgh, under Sir Wyville's superintendence, but, except for a few pencil notes upon one or two of them, he has unfortunately left no manuscript behind him of any kind. It has therefore become my duty to make good this deficiency; but as the other calls upon my time leave me only a limited amount of leisure, I fear that some months must yet elapse before the publication of the final report.

The "Blake" dredgings have shown that the bathymetrical range of the Stalked Crinoids is not always so great as has been often supposed. So far as my information goes, they have only been obtained fourteen times at depths exceeding 650 fathoms, their lowest limit being the celebrated deep dredging of the "Porcupine," in 1869, where *Bathycrinus*

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* *Ilycrinus carpenteri* of the Norwegian North Atlantic Expedition (Nyt Mag. for Naturvid., Bd. XXIII., 1877) is undoubtedly a *Bathycrinus*, though I do not think it is identical with *B. gracilis* of the first "Porcupine" Expedition (1869). The "Vega" dredged some Stalked Crinoids off the Siberian coast, and also a large *Metacrinus* in the North Pacific, but no descriptions of them have yet been published.

gracilis was obtained in 2435 fathoms. A young *Hyocrinus* (?) was dredged by the "Challenger" in 2325 fathoms, while *Antedon* was found at 2600 and at 2900 fathoms.

So far as I am aware, no entire *Pentacrinus* was obtained by the "Blake" at a greater depth than 250 fathoms,* while six of the "Challenger" species were found within that limit; though the "Porcupine" dredged *P. wyville-thomsoni* in 1095 fathoms in 1870, and the "Challenger" got a fragment of *P. naresianus* Wy. Th. MS., in the Pacific, at 1350 fathoms, this being the deepest *Pentacrinus* yet known. *Bathycrinus*, however, ranges from 1050 to 2435 fathoms, and *Hyocrinus* from 1600 to 2325 fathoms, while *Rhizocrinus lofotensis* occurs in the Norwegian fiords at 80 fathoms, and in 175 to 955 fathoms in the Caribbean Sea. It is a great pity that we have no later knowledge of the "Australian Encrinite" on a stem 6″ long, which was obtained by Poore † at a depth of 8 fathoms in King George's Sound.

It is well known that three genera of Stalked Crinoids occur in the Caribbean Sea besides the three *Comatulæ* ‡; viz. *Pentacrinus, Holopus,* and *Rhizocrinus.* The last-named is represented by two species, and the first by four, viz. *P. asteria* Linn. sp., *P. mülleri* Oerst., *P. decorus* Wy. Th., and *P. blakei* n. sp. The first of these, which is the type species of the genus, seems never to have been dredged by the "Blake," except perhaps in a fragmentary state. It is mentioned, however, by Mr. Agassiz § as having been dredged off Havana in 1878, but the individuals there referred to really belong to *P. mülleri;* while the very variable form with a slender stem, which Mr. Agassiz and the late Mr. Pourtalès have spoken of as *P. mülleri*, is really the *P. decorus* of Sir Wyville Thomson. These two species have hitherto been confused with one another, and it is only since I have been able to examine the original types of them in the Copenhagen and British Museums respectively, that I have succeeded in forming clear ideas about them. The relations of the Caribbean species to one another, and to the other species of the genus, are shown in the following scheme.

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* Specimens were obtained in as little as 42 fathoms, and stem fragments down to 470 fathoms.

† Ann. and Mag. Nat. Hist. (1862), Vol. IX. p. 486.

‡ *Antedon, Actinometra,* and *Atelecrinus.* See Bull. Mus. Comp. Zoöl., Vol. IX. No. 4.

§ Bull. Mus. Comp. Zoöl., Vol. V. No. 6, p. 56.

Genus PENTACRINUS Miller.

The two outer radials and the first two joints beyond each axillary united by syzygies.	Five cirri at each node.	Cirri large and stout, of 35-43 joints. Rays may divide five times.	Usually 15-18 internodal joints. The hypozygal does not share in the cirrus-sockets. Usually more than three joints between the irregular arm divisions. Pinnule joints have forward-projecting processes.	*asteria* Linn.
			6-8 internodal joints. The hypozygal shares in the cirrus-sockets. Only two or three joints between the regular arm divisions.	*mulleri* Oerst.
		15-25 cirrus-joints. Rays only divide three times; each division of two joints united by syzygy.	One or two internodal joints	*maclearanus* Wy. Th.
			35-45 internodal joints	*wyville-thomsoni* Jeffr.
	Two and three cirri alternately at successive nodes. Rays divide three times; each division of two joints united by syzygy. Four internodal joints.			*alternicirra* n. sp.
The two outer radials and the first two joints beyond them united by ligamentous articulations.	Ten arms. The third brachial a syzygy, with angular syzygial faces. First pinnule on the second brachial. 8-17 internodal joints.			*naresianus* Wy. Th. MS.
	Rays may divide three times. The second free brachial a syzygy. Pinnule on first brachial.		5-7 internodal joints. Nodal joints not enlarged, and the hypozygal sharing but little in the cirrus-sockets. Syzygial faces angular.	*blakei* n. sp.
			11 or 12 internodal joints. Nodal joints enlarged and projecting, and the hypozygal grooved to receive the cirrus-bases. Syzygial faces nearly plane.	*decorus* Wy. Th.

It will be seen from the preceding table that the Caribbean species of *Pentacrinus* are equally divided between the two groups into which the eight recent species of the genus very naturally fall. Of the remaining types, *P. wyville-thomsoni* and *P. maclearanus* both occur in the Atlantic, the former off the Portuguese coast and the latter off Pernambuco. *P. alternicirra* and *P. naresianus* were dredged by the "Challenger" off the Kermadec Islands, and also to the southeast of the Philippines, the latter species also occurring at another station in the South Pacific.

Most of the *Pentacrinidæ* obtained by the "Challenger" in the Pacific represent a new and very curious type, which Sir Wyville Thomson designated by the name of *Metacrinus* in a memorandum on one of his plates. It is readily distinguished from *Pentacrinus* by having, not three, but from four to six radials. The second of these is a syzygial joint, and bears a pinnule, as do all the following joints below the radial axillary. There are numerous other minor differences between *Metacrinus* and *Pentacrinus* which need not be considered here.

The examination of this large series of *Pentacrinidæ* fully confirms the views which I have expressed elsewhere * as to the difficulty of retaining the genus *Cainocrinus* Forbes, which has recently been resuscitated by De Loriol.* The distinguished Swiss paleontologist describes the basals of *Cainocrinus* as in contact with one another all round the calyx, so as to form a complete ring, while those of *Pentacrinus* are small and not contiguous externally, as shown in Miller's figure of *P. caput-medusæ* (*asteria* Linn.).† So far as the fossil species are concerned this certainly does appear to be a constant difference, but it is by no means so in the recent ones and in *Metacrinus*. The unique specimen of *P. maclearanus* ‡ has a closed basal ring, and so have all the examples of *P. wyville-thomsoni* that I have seen, though one or more of the basals occasionally fail to meet their fellows. But in *P. naresianus* there appears to be no constancy whatever in this respect. Some individuals of this species have a closed basal ring. But in others the basals are comparatively small and the radials are prolonged slightly downwards over the upper stem-joints. A few exhibit both conditions, some of the basals meeting their fellows, while the rest are separated by the downward projecting radials. The same variation, though in a less degree, occurs in *P. mülleri*. But it is in *P. decorus* that the most remarkable variation occurs in the size of the basals. They are sometimes smaller than those of *P. asteria*, and scarcely more conspicuous than the interradial ridges on the stem beneath them ; or they may be large triangular knobs standing out prominently from the general plane of the calyx, and meeting one another laterally by their extended lower angles ; or they may present any intermediate condition between these two.

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* Journ. Linn. Soc., Vol. XV. p. 210.

The following brief descriptions of the Caribbean species of *Pentacrinus* are not to be considered as complete specific diagnoses. These will appear, together with the synonymy, in my final report.

P. asteria Linn. sp.

Stem robust, reaching 6 or 7 mm. in diameter, with 13–21 (usually 15–18) internodal joints. Cirrus-sockets widely oval, and occupy nearly the whole height of the nodal joint. The hypozygal joints rarely modified, and then very slightly so.

Cirri reaching 70 mm. in length and composed of 50 stout joints. Lowest limit of the interarticular pores from the ninth to the twelfth node. The two outer radials united by syzygy. The ray-divisions somewhat irregular. Primary arms of 2–6 (distichal) joints ; secondary arms of 4–10 (palmar) joints, usually 6–8. Tertiary arms of 6–14 joints, and occasionally another division after 8 or 10 joints more. The first two joints after each axillary united by syzygy, with a pinnule on the epizygal. No other syzygies on the arms.

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* Monographie des Crinoïdes fossiles de la Suisse, (Geneva, 1877–79,) p. 111.

† A Natural History of the Crinoidea, (Bristol, 1821,) p. 51, Pl. II. fig. 9.

‡ The Atlantic, Vol. II. p. 124, fig. 31.

The joints of the large pinnules on the arm-bases have their distal edge raised into a strongly marked keel, which projects forwards over the base of the next joint. This feature recurs on all the pinnules of the arms, though it is less distinct in their middle and outer portions.

Remarks. — The above description is based on the examination which I have made of the following examples of the type: — (*a.*) Miller's original specimen from Nevis, now in the geological department of the British Museum. (*b.*) One dry specimen and another in spirit, both in the zoölogical department of the same Museum. (*c.*) One dry specimen in the Hunterian Collection of the Royal College of Surgeons. (*d.*) Two dry specimens obtained by Dr. Carpenter and Sir Wyville Thomson from Mr. Damon of Weymouth.

I have not seen either of the individuals described by Guettard * (Martinique) and Ellis † (Barbados); but judging from the figures given by these authors I have little doubt that they belong to the type which is now generally known as *P. asteria.* The specimen from Guadeloupe in the Museum of the Geological Society of London, which is mentioned by both Miller and Müller ‡ as a *P. caput-medusæ,* is really referable to Oersted's type *P. mülleri,* which is so well described in Lütken's classical memoir.§ If the sixth example mentioned by Müller || be the one formerly belonging to the Natural History Society at Copenhagen, and bought in 1846 by the University Museum, it is also a *P. mülleri.*

The peculiar features of the pinnules of *P. asteria* afford an excellent specific distinction. They are well shown in Miller's figure,¶ which represents a pinnule some little way out on the arms. In the lowest pinnules the tubercular projection at the distal end of each joint is very marked indeed; and it is recognizable, though of course less distinctly so, all along the arms; so that arm fragments of this species can be readily identified, which is more than can be said for most of the *Pentacrinidæ.*

The stem also, like the arms, has a definite character of its own, which has not always been correctly described. The nodal joint, i. e. that which is pierced by the canals lodging the cirrus-vessels, is united by syzygy to the joint below it, just as in *P. mülleri* and in all the *Pentacrinidæ;* but this lower or hypozygal joint is not grooved externally for the reception of the thick basal

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* Mém. de l'Acad. Roy. des Sci. Paris, 1755 (published 1761), pp. 228–247, Pl. VIII., IX.

† Phil. Trans., 1762, Vol. LII. Part I. pp. 357–362, Tab. XIII.

‡ Abhandl. d. Berlin. Akad., 1843, p. 185.

§ Om Vestindiens Pentacriner, med nogle Bemaerkninger om Pentacriner og Sölilier i Almindelighed. Videnskab. Meddel. fra den naturhist. Foren. i Kjöbenhavn, 1864, Nr. 13–16, pp. 195–245, Tab. IV., V.

|| *Loc. cit.*

¶ *Loc. cit.*, p. 51, Pl. II. fig. 5.

portions of the cirri, as is markedly the case in *P. decorus*, and less so in *P. mülleri* and in most species of the genus. It has therefore often been said that the nodal joints of *P. asteria* are simple and low, while those of *P. mülleri* are double and thick. This is not strictly true. The nodal joints are always single and united by syzygy to those next below them, though the line of junction is frequently almost obliterated. The hypozygals may be modified to receive the cirrus-bases, as in *P. mülleri* and *P. decorus*, or they may not differ in external appearance from the other internodal joints, as in *P. asteria* and *P. wyville-thomsoni*. In this last species, however, the joint above the node is slightly excavated to receive the wide basal portions of the cirri, and this character is still more marked in the genus *Metacrinus*.

P. mülleri OERST.

Stem generally robust, reaching 6 mm. in diameter, with 4–10 (usually 6–9) internodal joints. The cirrus-sockets, which do not reach the upper edges of the nodal joints, are variable in shape. Some are oval, and encroach but little on the hypozygal, while others are more circular and extend well down on to it.

Cirri reaching 50 mm. in length and composed of about 40 stout joints.

Lowest limit of the interarticular pores from the fourth to the eighth node.

The two outer radials united by syzygy. There are usually 6 or 8 arms on each ray in the following order, 2, 1 ; 1, 2, or 2, 1, 1 ; 1, 1, 2, the axillaries being limited to the outer arm of each successive pair. Primary arms of 2 (distichal) joints, which are united by syzygy. Secondary arms of 2–7 (palmar) joints, usually 3. The two following divisions are usually of 3 joints each, but may have 5 or 6. The first two joints after the palmar and subsequent axillaries are united by syzygy with a pinnule on the epizygal. No other syzygies on the arms.

The lower joints of the pinnules are somewhat prismatic, and the following ones laterally compressed, with sharp dorsal edges.

Examples of this type were dredged by the "Blake" at the following stations * : —

1877–78. Off Havana. 175 fathoms.
1878–79. No. 193. Off Martinique. 169 fathoms.
No. 291. Off Barbados. 200 fathoms.

Remarks.— A dry example of this species was obtained by Sir Wyville Thomson from Mr. Damon, and a spirit one was brought home from Barbados by Sir Rawson Rawson. Its stem is readily distinguished from that of *P. asteria* by the shortness of the internodes and the modification of the hypozygal joints, which, however, is far less marked than in *P. decorus*. The basals generally form a complete ring; while the branching of the arms is much more regular than in *P. asteria*, and there are fewer joints between the successive axillaries.

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* The complete list of localities for the different Crinoids dredged by the "Blake" will doubtless be drawn up by Mr. Agassiz and his assistants. I cannot, of course, do more than record the localities of the selected specimens which have been sent to Europe for study.

P. decorus Wyv. Thomson.

Stem slender, rarely exceeding 4 mm. in diameter, with 7–16 (usually 11 or 12) internodal joints. The nodal joints are generally somewhat enlarged, with circular cirrus-sockets which do not nearly reach their upper edge, but extend well down on to the hypozygal joints.

Slender cirri composed of 25–35 joints, and reaching 28 mm. in length.

Lowest limit of the interarticular pores from the ninth to the eleventh node.

The two outer radials united by a ligamentous articulation. Ray-divisions rather irregular. Primary arms of 2–7 (distichal) joints, of which the first two are united by a ligamentous articulation, the second bearing a pinnule, while the last two often form a syzygy. Secondary arms of 1–9 (palmar) joints, which are very variable in their character. The second free brachial is usually a syzygial joint. The next syzygy from the eighth to the thirtieth brachial, after which an interval of 5–11 joints between successive syzygies.

A pinnule on the first joint after the last axillary. Pinnule joints laterally compressed, those at the base of the lower pinnules being rather broad, but the following ones are elongated.

Examples of this type were dredged by the "Blake" at the following stations: —

1877–78. Off Havana. 175 and 177 fathoms; very abundant.
1878–79. Nos. 155 and 156. Off Montserrat. 88 fathoms.
No. 269. Off St. Vincent. 124 fathoms.

Remarks.— The distinctness of this species from *P. asteria* was first recognized by Mr. Damon of Weymouth, who procured an example of it from the seas of the outer Antilles. Its occurrence was recorded by the late Sir Wyville Thomson in a popular article on "Sea Lilies," which was published in the "Intellectual Observer" for August, 1864, but no formal description of it has since appeared. At that time Sir Wyville seems to have been unacquainted with the description of *P. mülleri* by Oersted, published six years previously, for he spoke of *P. asteria* and *P. decorus* as "the only two known living species" of Stalked Crinoids. But in the following year * he referred to *P. mülleri* as well, Lütken's memoir having appeared in the interval; so that he evidently regarded *P. decorus* and *P. mülleri* as separate species. Later on (1872), however, he seems to have come to the conclusion that his *P. decorus* was identical with Oersted's species. For, having previously said that *P. asteria* and *P. decorus* were the only two known living species of the genus, he made nearly the same statement † concerning *P. asteria* and *P. mülleri*. He likewise repeated most of his original description of *P. decorus* as a diagnosis of *P. mülleri*, with a reference under the latter name to the specimen which he had before him when describing *P. decorus*. He stated that the two outer radials of *P. asteria* are united by syzygy, and further added that "the arrangement of the joints and the syzygies in the cup is the same in *P. mülleri* as in *P. asteria*, only the syzygy between the second radial and the radial axillary is not so complete." This description obviously refers to a ligamentous articulation as distinguished from a true syzygy on the one hand, and from a muscular joint on the other; and it is by no means in accordance with Lütken's very positive statements * as to the presence of a syzygy between the two outer radials of *P. mülleri*. Neither does Sir Wyville's description of the nodes as occurring about every twelfth joint agree with Lütken's diagnosis, which only records 4–10 internodal joints in *P. mülleri*. As a matter of fact there are 11 or 12 internodal joints in *P. decorus*, and there is no syzygy at all between the two outer radials, but only a ligamentous articulation such as occurs in the majority of the *Neocrinoidea*, and has often been wrongly spoken of as a syzygy, though clearly distinguished from it by Müller.

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* Phil. Trans., Vol. CLV. p. 542.

† On the Crinoids of the "Porcupine" Deep-Sea Dredging Expedition, Proc. Roy. Soc. Edinb., Vol. VII. pp. 765–767; and "The Depths of the Sea," pp. 434–442. See also "The Atlantic," Vol. II. p. 126.

Had Sir Wyville lived to work out the "Blake" collection more fully than he was able to do before his health gave way, I cannot but think that he would have returned to his original views as to the distinctness of his *P. decorus* from Oersted's *P. mülleri*. The two species have really no sort of resemblance to one another, differing in all the characters of the stem, the cirri, the calyx, and the arms.

Curiously enough, *P. decorus* appears to be the most common species of the genus in the Caribbean Sea. One of the "Blake" specimens is remarkable for the total absence of cirri along the whole of one face of the stem; while at one of the nodes two more cirri are missing, so that there are only two present instead of the usual five.

P. blakei n. sp.

Stem slender, not reaching 4 mm. in diameter with 5–7 internodal joints. Nodal joints not enlarged. The small circular cirrus-sockets do not nearly reach their upper edges, and extend but slightly downwards on to the hypozygals.

Slender cirri composed of 25 joints and barely 20 mm. long.

Lowest limit of the interarticular pores from the sixth to the tenth node.

The two outer radials united by a ligamentous articulation. Usually only 4 arms on each ray. Primary divisions of 1–4 (distichal) joints, of which the first two are united by a ligamentous articulation. If 4 distichals are present, the second bears a pinnule and the two outer ones form a syzygy. The first free brachial bears a pinnule, and the second is usually a syzygial joint, while other syzygies occur on the arms at very irregular intervals. The proximal face of the epizygal forms a sharp angle which projects backwards into the retreating distal face of the hypozygal.

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* *Loc. cit.*, pp. 201, 202.

Examples of this species were dredged by the "Blake" at the following stations : —

1878–79. No. 157. Off Montserrat. 120 fathoms.
No. 281. Off Barbados. 200 fathoms.

Remarks. — This species is at once distinguished from *P. decorus* by the shortness of the internodes of the stem and the absence of any enlargement at the nodes. The calyx is closely similar to that of the variety of *P. decorus* with small basals, but the arm-bases have a totally different appearance from those of that type, owing to the peculiar nature of the syzygy in the second brachials and in the subsequent syzygial joints. The two apposed faces are not plane as is usually the case, but the hypozygal has its distal face sharply incised, while the proximal face of the epizygal is in two planes, which make a sharp angle with one another and project backwards into the hypozygal. This peculiarity is best seen in a side view of the arm, unless the joints are separated by boiling with potash or soda. The only other species of *Pentacrinus* in which it occurs is the ten-armed *P. naresianus* from the Western Pacific. In both cases it may be traced in all the syzygies of the arms, so that small fragments of them are easily recognizable.

Both the recent species of *Rhizocrinus* occur in the Caribbean Sea. *R. lofotensis* was dredged in the Florida Straits by the late Mr. Pourtalès, a few months before the publication of M. Sars's well-known description of it; and *R. rawsoni*, first found by the "Hassler" off Barbados, was subsequently obtained by the "Blake" in 1877–78 and 1878–79.

So far as my information goes, the distribution of these two species is as follows : —

R. lofotensis.

Bibb. 1868. Off the Samboes. 237 fathoms.
Off Sand Key. 248 and 306 fathoms.
1869. Off Cojima near Havana. 450 fathoms; and several times at lesser depths.
Blake. 1877–78. No. 29. Lat. 24° 36′ N., Long. 84° 5′ W. 955 fathoms.
No. 43. Lat. 24° 8′ N., Long. 82° 51′ W. 339 fathoms.
No. 44. Lat. 25° 33′ N., Long. 84° 35′ W. 539 fathoms.
No. 56. Off Havana. Lat 22° 9′ N., Long. 82° 21′ 30″ W. 175 fathoms.

R. rawsoni.

Hassler. 1872. Off Sandy Bay, Barbados. 100 fathoms.
Blake. 1877–78. No. 32. Lat. 23° 32′ N., Long. 88° 5′ W. 95 fathoms.
Off Havana. 175 fathoms.

Mr. Agassiz mentions in his dredging letters that he obtained a number of specimens of *Rhizocrinus* among the Windward Islands in 1878–79, and a few specimens in 1880 on the line from Cape Hatteras to St. George's Shoal; but not having seen any of them, I can say nothing as to the species which they represent.

In 1869 two examples of this genus were obtained by the "Porcupine" off Cape Clear, in 862 fathoms (No. 42), and were referred at the time to *R. lofotensis.* On comparing them, however, with some specimens of *R. rawsoni* from off Havana, I find that they really belong to this type, as I had always suspected since reading Pourtalès's description of it.* *R. rawsoni* was also dredged by the "Challenger" in 900 fathoms among the Azores. It is readily distinguished from *R. lofotensis* by its more robust appearance and elongated calyx, which is nearly always constricted at the basiradial suture, instead of widening gradually upwards, as does that of *R. lofotensis.* The first radials are much shorter relatively to their width than in *R. lofotensis,* and the epizygal of the syzygial first brachial is not markedly narrower than the hypozygal as in the latter species. The greater part of the cup is formed by the elongated basals. In the Norwegian variety of *R. lofotensis* these fuse so very completely that no sutures are usually visible on the exterior of the calyx. This led Sars † and Ludwig ‡ to suggest that the basals of the young *Rhizocrinus* undergo metamorphosis into a "rosette," as in most *Comatulæ,* though this view is not supported by the observations of Pourtalès § and myself; ‖ and the fact that the so-called "enlarged upper stem-joint" of *R. lofotensis* really consists of the anchylosed basals as originally stated by Mr. Pourtalès ¶ for the Caribbean variety is now generally recognized.** The difference in the relative proportions of the two species is seen in the following table, which also shows the sizes of the stem-joints in the examples of *R. rawsoni* that were dredged by the "Blake," "Challenger," and "Porcupine" respectively, and in Sars's largest specimens of *R. lofotensis.*

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* Zoölogical Results of the "Hassler" Expedition, Ill. Cat. Mus. Comp. Zoöl., No. VIII. pp. 27–31.

† Mémoires pour servir à la Connaissance des Crinoïdes Vivants, p. 12.

‡ Morphologische Studien an Echinodermen, Band I. pp. 120–122.

§ *Loc. cit.*, p. 29.

‖ On some Points in the Anatomy of *Pentacrinus* and *Rhizocrinus.* Journ. Anat. and Phys., Vol. XII. pp. 48–53.

¶ Contributions to the Fauna of the Gulf Stream at great Depths. Bull. Mus. Comp. Zoöl., Vol. I. No. 7, pp. 128–130.

** Zittel's Handbuch der Palaeontologie. Palaeozologie, Band I. p. 393.

Expedition.	Depth.	Base.		Length of Stem.	Stem-Joints.		
		Height.	Width.		No.	Length.	Width.
	fath.	mm.	mm.	mm.		mm.	mm.
Blake	175	5.5	2.50	180	68	3.50	2.25
Challenger	900	5.0	2.00	150	53	3.00	2.00
Porcupine	862	3.0	1.75	50	30	2.25	1.25
G. O. Sars *R. lofotensis*	300 (maximum.)	2.0	1.50	70	67	1.50	0.50

N. B. — Pourtalès described his largest specimen of *R. lofotensis* as having a stem nearly 130 mm. long and composed of 59 joints, the length of which averages three times their diameter.

The stem-joints of *R. rawsoni* are relatively shorter and thicker than those of *R. lofotensis*, in which the length is three times the width. In absolute size, as well as in the proportions of the basals and of the stem-points, the "Porcupine" examples of this type are the ones which approach *R. lofotensis* most nearly. They are smaller than those from the Azores, which are themselves smaller than the Caribbean specimens, a fact which is doubtless due to variations of temperature. The difference in size between the largest specimens of *R. lofotensis* found by Sars and Pourtalès respectively is likewise probably the result of the difference between the temperature of the Gulf Stream in the Florida Straits and that of the Northeast Atlantic. It is noteworthy that an elongated calyx resembling that of *R. rawsoni* is chiefly found in those individuals of *R. lofotensis* which have the arms best developed ;* so that this species probably represents a further stage in the degradation of the Apiocrinite type than is reached by *R. rawsoni*. The occurrence of the latter form in the Eastern Atlantic is of extreme interest, owing to its remarkable resemblance to *Bourgueticrinus londinensis*. This type was named by Forbes from some isolated stem-joints in the London clay ; but a well-preserved calyx has since been discovered, which is now preserved in the Natural History Museum at South Kensington.

Several species closely allied to *B. londinensis*, which occur in the Tertiary deposits of France and Italy, are referred by Zittel † and other palæontologists to the genus *Conocrinus* D'Orbigny ; e. g. *C. pyriformis* Münst. sp., *C. thorenti* D'Arch. sp., *C. cornutus* Schafh. sp., *C. suessi*

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* Sars, Crinoïdes Vivants, p. 4.

† Palaeontologie, p. 392. See also Meneghini, "I Crinoidi Terziarii," Atti d. Soc. Tosc., Vol.II. pp. 11–17. Schluter, "Ueber einige Astylide Criuorden," Zeitsch. d. deutsch geol. Gesellsch., 1878, pp. 52–55. De Loriol, "Crinoïdes fossiles de la Suisse," p. 190 ; and Paléontologie Française, "Terrain Jurassique," Tom. XI. (1882), p. 65.

Munier-Chalmas sp., and *C. seguenzai* Menegh. That they are congeneric with Forbes's species and with *Rhizocrinus* I have not the smallest doubt; and the question therefore arises whether *Conocrinus* D'Orbigny is to take precedence over *Rhizocrinus* Sars.

On this subject Prof. Zittel remarks, "Nach den Regeln der Priorität gebührt dem Namen *Conocrinus* D'Orb. die Priorität, wenn gleich die Gattungsdiagnose D'Orbigny's unvollständig und theilwise unrichtig ist."

The type on which D'Orbigny founded *Conocrinus* was the *Bourgueticrinus thorenti* of D'Archiac,. but his definition of it was so incomplete and so incorrect that, even supposing Sars had not defined *Rhizocrinus* as elaborately as he did, I should not admit *Conocrinus* as a valid genus until it had been re-defined. Lütken * remarked, in 1864, that its distinctness from *Bourgueticrinus* was still a matter of uncertainty. D'Orbigny † spoke of it as "Genre voisin des *Bourgueticrinus*, mais sans pièces basales comme les *Eugeniacrinus*"; and again, "C'est un *Bourgueticrinus* ayant la tige comprimée, mais avec une seule série de pièces basales." If he considered it as near *Bourgueticrinus* and as resembling *Eugeniacrinus*, why did he omit it altogether from the tabular scheme of the *Apiocrinidæ*, which appears on page 2 of his "Histoire Naturelle des Crinoïdes Vivans et Fossiles," and contains the names of both those genera? It would seem from his reference to the absence of any tertiary species of *Bourgueticrinus* on page 96 that he included them all in *Conocrinus*, which would belong to a different family altogether. This shows how he had misunderstood its real character and affinities, and as a matter of fact his description of it as having no basals is entirely incorrect. They are visible enough in D'Archiac's figures of *B. thorenti* (the type-species of *Conocrinus*), and in other closely allied species. Lastly, the remark that *Conocrinus* is a *Bourgueticrinus* with a compressed stem, is worthless as a generic description, when the latter genus itself is described as having a round *or compressed* stem.

The differences between the two types are of an entirely different character from those mentioned by D'Orbigny, which would be absolutely unintelligible in the absence of figures or of original specimens. I feel it only right, therefore, to ignore *Conocrinus* altogether, and to adopt Sars's well-known genus *Rhizocrinus*.

The differences between *Apiocrinus* and *Millericrinus* on the one hand, and *Bourgueticrinus* and *Rhizocrinus* on the other, have led Mons. de

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* *Loc. cit.*, p. 212.

† Prodrome de Paléontologie Stratigraphique Universelle, 1850, Tom. II. p 332.

Loriol[*] to establish a new family *Bourgueticrinidæ*, which comprises the two genera just mentioned, together with *Bathycrinus* and *Mesocrinus*, a genus recently proposed by myself. De Loriol also includes in it *Ilycrinus* of Danielssen and Koren; but this genus is certainly identical with *Bathycrinus*, which was founded by Sir Wyville Thomson[†] on an immature specimen dredged by the "Porcupine" in 2435 fathoms, two hundred miles south of Cape Clear. His description[‡] of the larger species, *B. aldrichianus*, from the Southern Sea, seems not to have reached the Norwegian naturalists before the publication of their genus *Ilycrinus*, which was founded on much more developed individuals than that dredged by the "Porcupine."

Of the four genera included in De Loriol's new family, *Bourgueticrinus* and *Rhizocrinus* are the two most closely allied. The differences between them are greater than was supposed by Sars, owing to his mistake about the basals of the latter type, and may be summarized as follows: —

Bourgueticrinus. Lower stem-joints not longer than wide; while one or two at the top of the stem are much longer than those below, and help to form the "summit." Basals usually wider than high.

Rhizocrinus. Lower stem-joints usually much elongated, two or three times as long as wide. Those just below the calyx are the shortest, often being mere disks. Basals usually much longer than wide, occupying the greater part of the length of the calyx, which expands somewhat from below upwards.

The last type to be mentioned is the remarkable genus *Holopus*, about which much information will be found in a communication[§] by Sir Wyville Thomson to the Royal Society of Edinburgh, in 1877. Since the publication of this paper Sir Wyville made a horizontal section of the cup about two thirds of its height from the base. I was never fortunate enough to learn his own views on the subject, but the appearance of the section leads me to believe that the lower part of the cup is formed by basal plates which project inwards and upwards above the level of the outer edges of the radials, just as in *Pentacrinus*.[||]

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[*] Paléont. Franç., *loc. cit.*, p. 63.

[†] The Depths of the Sea, pp. 450–454, fig. 73; and Proc. Roy. Soc. Edinb., Vol. VII. pp. 772, 773.

[‡] "Notice of new Living Crinoids belonging to the Apiocrinidæ," Journ. Linn. Soc. Zoölogy, Vol. XIII. pp. 48–51.

[§] "On the Structure and Relations of the Genus *Holopus*," Proc. Roy. Soc. Edinb., Vol. IX. p. 409.

[||] Schlüter (*loc. cit.*, p. 51) is inclined to believe that basals are present in *Cyathidium spileccense*. Like Sir Wyville Thomson, I am unable to differentiate *Cyathidium* from *Holopus*.

Sir Wyville left it an open question whether the articular facets on the upper edge of the calyx-tube belong to the first or to the second radials. I believe myself that they are of the former nature, partly on account of their great resemblance to those of certain fossil species, and partly because the axillaries appear to me to be syzygial or double joints.

Sir Wyville has pointed out that the cup exhibits a very marked division into bivium and trivium; for "one side of the border is much thicker and considerably higher than the other side, and the three arms articulated to it are much larger than those articulated to the opposite side." In fact, the three facets of the trivium are themselves unequal, the centre one being both longer and wider than the other two, which are themselves longer and a little wider than the two facets of the bivium. This want of symmetry in the calyx is very remarkable, as it is precisely similar to that described by De Loriol * in *Eugeniacrinus mayalis*, from the *Leptæna* bed (Middle to Upper Lias) of Calvados in Normandy. The calyx of this species, formed by the five contiguous radials, tapers away downwards to a truncated extremity, which De Loriol supposes to have rested on the top stem-joint, basals being apparently absent.

But although *Eugeniacrinus mayalis* probably had a short stem, it is certainly very closely allied to *Holopus*. The calyx as well as the second and third radials are covered with scattered granules of variable size, just as in *Holopus*. The two outer radials were united by a muscular joint; but in a closely allied species, *E. deslongchampsi*, which is more symmetrical and less coarsely granular than *E. mayalis*, they are united by syzygy, just as I believe to be the case in *Holopus*. Together with the calyces and separate radials of these two species, the *Leptæna* bed contains a large number of isolated arm joints,† some of which are extraordinarily like those forming the lower part of a *Holopus* arm.

One reason why I suspect the axillaries of *Holopus* to be syzygial joints is as follows. In one individual the axillaries on the two rays of the bivium are distinctly in two parts, though the sutural lines do not extend right across them. On the three axillaries of the trivium, however, no sutural lines are visible at all; though they are just traceable in another specimen, and are fairly distinct in a young one 8 mm. high.

The condition of the very young individual which was obtained by the "Blake" at Station 22, and was figured in Volume V. No. 9 of the

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* Paléontologie Française. Terrain Jurassique, Tom. XI. p. 78, Pl. VIII. figs. 1–5.

† *Loc. cit.*, Pl. XI.

"Bulletins," seems to point to the same conclusion; for the lower ring of pentagonal (or rather hexagonal) plates must surely be the second radials, and the triangular ones above them the axillaries.

A fragment of a living *Holopus* was dredged by the "Blake" in 120 fathoms, off Montserrat (No. 157). It was preserved in spirit and sent over to Sir Wyville Thomson, who asked me to cut some sections of the arms for him. The condition of the dried individuals hitherto known had led him to suspect "that the tissues are very imperfectly differentiated, almost protoplasmic. When an arm is put into boiling water it falls to pieces at once, the joints simply coming asunder, and showing no trace of muscular or other organic connection except the axial cords of the joints, which sometimes keep two joints hanging in connection for a little." The spirit specimen, however, told a different tale altogether, and the sections which I have made from it show that the soft parts of *Holopus* differ but little from those of any ordinary Crinoid. The arm-joints are articulated by means of muscles and ligaments in the usual way. The two large arm-canals, the cœliac and the subtentacular, are separated by a smaller genital canal containing the genital cord. This has exactly the same structure as that of any common *Antedon*, and the ovaries which it bears at intervals are much more like those of *Antedon eschrichti* in their histological structure than are those of many *Comatulæ*. The ambulacral groove is quite narrow in proportion to the breadth of the arm, and the ovaries extend but a very little way into the pinnules. The branches which leave the axial cords of the arms to supply the pinnules take a somewhat singular course. For they are thrown into loops in a dorsoventral direction, which are small at first, immediately beneath the arm-canals, but become much more marked at the bases of the pinnules, within which the cords still retain an undulating course.

Above the water-vessel is the usual darkly colored ambulacral epithelium, which is doubtless separated from the water-vessel by the ambulacral nerve and bloodvessel, though I have not been able to see them clearly. There are no large and imbricated reniform plates at the sides of the ambulacra, such as occur in *Rhizocrinus*, *Bathycrinus*, and *Hyocrinus*. But the tentacles are unusually large, and taper rapidly from a broad base; while the lower thick part of the shaft of each tentacle is protected by a well-developed calcareous reticulation, above which are groups of more or less closely united spicules.

Eton College, September, 1882.

List of Additional Stations of Stalked Crinoids collected by the "Blake." *Prepared by* J. WALTER FEWKES.

RHIZOCRINUS.

R. lofotensis SARS.

* Blake,	1877–78.	No. 35.	Lat. 23° 54′ 46″ N.† Long. 88° 58′ W.	804 fath.
"	1878–79.	No. 238.	Off Grenadines	127 "
"	"	No. 248.	Grenada	161 "
"	"	No. 259.	Grenada	159 "
"	"	No. 274.	Barbados	209 "
"	1880.	No. 306.	Lat. 41° 32′ 50″ N. Long. 65° 55′ W.	524 "
‡ U. S. Fish Com.	1882.	No. 1124.	S. S. E. Off Nantucket . .	640 "

R. rawsoni POURTALÈS.

Blake,	1878–79.	No. 155.	Montserrat	88 fathoms.
"	"	No. 166.	Guadeloupe	150 "
"	"	No. 177.	Dominica	118 "
"	"	No. 211.	Martinique	357 "
"	"	No. 273.	Barbados	103 "
"	"	No. 277.	Barbados	106 "
"	"	No. 290.	Barbados	73 "
"	"	No. 296.	Barbados	84 "
"	"	No. 297.	Barbados	123 "
Capt. E. Cole.			Saba Bank	200 "

PENTACRINUS.

P. asteria LINN.

* Blake,	1878–79.	No. 157.	Montserrat	120 fathoms.
Dr. Schramm.			Guadeloupe	Depth ?

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* The identifications on labels in bottle with specimens, marked in this list with an asterisk, are in Mr. Pourtalès's handwriting.

† In list of Stations, Bull. Mus. Comp. Zoöl., Vl. 1, p. 9, Lat. reads 23° 52′.

‡ Verrill, American Journal, November, 1882.

P. mülleri Oersted.

Blake, 1878–79.	No. 100.	Off Morro Light	250–400	fathoms.
“ “	No. 101.	Off Morro Light	175–200	“
“ “	No. 157.	Montserrat	120	“
“ “	No. 171.	Guadeloupe	183	“
“ “	No. 218.	St. Lucia	164	“
“ “	No. 269.	St. Vincent	124	“
* “ “	No. 274.	Barbados	209	“
“ “	No. 280.	St. Charles Lighthouse (Barbados)	221	“
“ “	No. 283.	Barbados	237	“
“ “	No. 295.	Barbados	180	“
“ “	No. 296.	Barbados	84	“
“ “	V.	Santiago de Cuba (Bartlett)	288	“

P. decorus Wyville Thomson.

Blake, 1877–78.	No. 21.	Bahia Honda (Cuba)	287	fathoms.
W. Stimpson.		Cuba.		
Blake, 1877–78.		Off Havana (Sigsbee)	150–200	“
“ “	No. 56 or 57.	Lat. 22° 9′ 15″ N., Long. 82° 21′ W. (Sigsbee)	175	“
“ 1878–79.	No. 100.	Off Morro Light	250–400	“
Capt. E. Cole.		S. side of Porto Rico	667	“
Blake, 1878–79.	No. 101.	Off Morro Light, Havana	175–250	“
“ “	No. 156.	Plymouth, Montserrat	88	“
“ “	No. 157.	Montserrat	120	“
“ “	No. 233.	Milligan’s Key, St. Vincent	174	“
“ “	No. 296.	Barbados	84	“
“ “	No. 298.	Barbados	120	“
Gov. Rawson (ident. by Mr. Pourtalès as *P. mülleri*).		Barbados.	Depth ?	
Blake, 1880.		Kingston (Bartlett)	100	fathoms.

P. blakei P. H. Carpenter.

Blake, 1878–79.	No. 209.	Martinique	189	fathoms.
“ “	No. 295.	Barbados	180	“

No. 5. — *Reports on the Results of Dredging under the Supervision of* ALEXANDER AGASSIZ, *on the East Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XIX.

Report on the Fishes. By G. BROWN GOODE and TARLETON H. BEAN.

THE specimens discussed in the following preliminary report were obtained by Mr. Agassiz in the dredge and trawl, during the summer of 1880, off the eastern coast of the United States between George's Bank and a line eastward from the vicinity of Charleston, South Carolina, between north latitude 31° 57′ to 41° 35′, and west longitude 65° 35′ to 78° 18′, at depths varying from 44 to 1632 fathoms.

Many of the same species were obtained by the United States Fish Commission in the deep waters off Newport and Wood's Holl, in 1880, 1881, and 1882, as well as by various Gloucester fishermen collecting on the fishing banks for the National Museum.

Drawings have been prepared to accompany the following descriptions, mainly from material collected by Mr. Agassiz. These are not published in connection with this preliminary report, but are retained for the illustration of a monograph of the deep-sea fishes of the Western Atlantic, which is now in an advanced state of preparation.

Allusion is frequently made in the following pages to the mutilated condition of the specimens sent to us for examination. It seems only fair to ourselves to call attention to the unsatisfactory state of the material investigated, since in some instances our most studious efforts have resulted in only partially complete descriptions. At the same time, it should be said that specimens of fishes brought up from such great depths are rarely perfect after they have been separated from the mass of mud and hard-shelled invertebrates which are usually found in the same localities, and that the tanks containing these collections were, for want of space, packed in a part of the ship close to the boiler-room, where, much to their detriment for descriptive purposes, they were partially cooked.

The Selachians collected by the "Blake" were described by Mr. Samuel Garman in the Bulletin of the Museum of Comparative Zoölogy, Vol. VIII. No. 11. A list of the stations referred to below is given in the same serial, Vol. VIII. No. 4.

LIST OF SPECIES COLLECTED AT STATIONS 302–346.

Pleuronectidæ.

1. **Aphoristia nebulosa**, new species.
2. **Notosema dilecta**, new species and genus.
3. **Monolene sessilicauda**, Goode.
4. **Citharichthys arctifrons**, Goode.
5. **Glyptocephalus cynoglossus** (Linn.), Gill.

Macruridæ.

6. **Macrurus Bairdii**, Goode & Bean.
7. **Macrurus carminatus**, Goode.
8. **Macrurus asper**, new species.
9. **Coryphænoides rupestris**, Müller.
10. **Coryphænoides carapinus**, new species.
11. **Chalinura simula**, new species and genus.

Brotulidæ.

12. **Barathrodemus manatinus**, new species and genus.
13. **Dicrolene introniger**, new species and genus.

Gadidæ.

14. **Phycis chuss** (Walb.), Gill.
15. **Phycis tenuis** (Mitch.), DeKay.
16. **Phycis regius** (Walb.), Jor. & Gilb.
17. **Phycis Chesteri**, Goode & Bean.
18. **Læmonema barbatula**, new species.
19. **Haloporphyrus viola**, Goode & Bean.
20. **Onos cimbrius** (Linn.), Goode & Bean.
21. **Merlucius bilinearis** (Mitch.), Gill.

Lycodidæ.

22. **Lycodes Verrillii**, GOODE & BEAN.
23. **Lycodes paxilloides**, new species.
24. **Lycodonus mirabilis**, new species and new genus.
25. **Melanostigma gelatinosum**, GÜNTHER.

Triglidæ.

26. **Prionotus alatus**, new species.

Agonidæ.

27. **Peristedium miniatum**, GOODE.

Cottidæ.

28. **Icelus uncinatus** (REINH.), KRÖYER.
29. **Cottunculus microps**, COLLETT.
30. **Cottunculus torvus**, new species, GOODE.

Scorpænidæ.

31. **Setarches parmatus**, GOODE.
32. **Sebastoplus dactylopterus** (DE LA ROCHE), GILL.

Carangidæ.

33. **Caranx amblyrhynchus** ?

Berycidæ.

34. **Poromitra capito**, new species and genus.

Synodontidæ.

35. **Bathysaurus Agassizii**, new species.

Alepocephalidæ.

36. **Alepocephalus Agassizii**, new species.

Halosauridæ.

37. **Halosaurus macrochir**, GÜNTHER.

Stomiatidæ.

38. **Stomias ferox**, REINHARDT.

Sternoptychidæ.

39. **Sternoptyx diaphana**, HERMANN.
40. **Argyropelecus hemigymnus**, COCCO.
41. **Cyclothone lusca**, new species and genus.

Scopelidæ.

42. **Scopelus Mülleri** (GMELIN), COLLETT.

Microstomidæ.

43. **Hyphalonedrus chalybeius**, GOODE.

Saccopharyngidæ.

44. **Saccopharynx flagellum**, MITCHILL.

Synaphobranchidæ.

45. **Synaphobranchus pinnatus** (GRONOW), GÜNTHER.

Murænesocidæ.

46. **Nettastoma procerum**, new species.

Nemichthyidæ.

47. **Nemichthys scolopaceus**, RICHARDSON.

Leptocephalidæ.

48. **Leptocephalus** sp. (Perhaps larva of *Synaphobranchus.*)

Raiidæ.

49. **Raia plutonia**, GARMAN (new to this collection).
50. **Raia ornata**, GARMAN (new to this collection).

Scylliidæ.

51. **Scyllium retiferum**, GARMAN (new to this collection).

Myxinidæ.

52. **Myxine glutinosa**, LINNÉ.

LIST OF STATIONS AT WHICH FISHES WERE TAKEN,

With an Enumeration of the Species identified from each Station, and the Length of the Individuals.

STATION 302.

1 *Phycis* sp. Unidentifiable. Young. 61 mm.

STATION 303.

25 *Macrurus Bairdii.* Young and old. 55–221 mm.
4 *Phycis Chesteri.* 155–315 mm.
1 *Haloporphyrus viola.* 332 mm.
1 *Icelus uncinatus.* 50 mm.
1 *Scopelus Mülleri.* 56+ mm.
12 *Synaphobranchus pinnatus.* Spawning. 221–393 mm.
1 *Nemichthys scolopaceus.* 590 mm.
2 empty eggs of *Raia* sp.

STATION 304.

1 fish, perfectly unidentifiable, — mutilated.

STATION 305.

6 *Coryphænoides carapinus.*
1 *Haloporphyrus viola.* 450 mm.

STATION 306.

12 *Macrurus Bairdii.* 121–310 mm.
1 *Coryphænoides rupestris.* 804 mm.
13 *Haloporphyrus viola.* 116–375 mm.
3 *Cottunculus torvus.* 62–211 mm.
1 *Stomias ferox.* 125 mm.
1 *Nemichthys scolopaceus.* 395 mm.
1 *Myxine glutinosa.* 465 mm.

STATION 308.

5 *Macrurus asper.* 178–350 mm.
4 *Coryphænoides carapinus.* 210, 230, 268, and 280 mm.
1 *Chalinura simula.* 481 mm.
5 *Haloporphyrus viola.* 253–372 mm.
1 *Halosaurus macrochir.* 680 mm.

Station 309.

13 *Macrurus Bairdii.* 55–283 mm.
1 *Macrurus asper.* 235 mm.
2 *Lycodes paxilloides.* 210–227 mm.
2 *Lycodes Verrillii.* 98–135 mm.
1 *Phycis tenuis.* 620 mm.
2 *Merlucius bilinearis.*
1 *Scopelus Mülleri.* 40 mm.
1 *Stomias ferox.* 140 mm
35 *Synaphobranchus pinnatus.* 278–440 mm.
1 *Nemichthys scolopaceus.* 530 mm.
1 *Myxine glutinosa.* 412 mm.

Station 310.

2 *Cottunculus microps.* 75–108 mm.

Station 311.

1 *Citharichthys arctifrons.* 149 mm.
1 *Phycis chuss.* 390 mm.
1 *Merlucius bilinearis.* 505 mm.
1 *Sebastoplus dactylopterus.* 45 mm.

Station 312.

12 *Macrurus Bairdii.* 240–340 mm.
2 *Haloporphyrus viola.* 225–280 mm.
1 *Lycodes paxilloides.* 247 mm.
18 *Synaphobranchus pinnatus.* 455–480 mm.

Station 313.

8 *Citharichthys arctifrons.* 18–48 mm.
4 *Notosema dilecta.* 92–114 mm.
1 *Prionotus alatus.* 137 mm.
1 *Raia* sp.
2 *Merlucius bilinearis.* Young. 17–25 mm.

Station 314.

2 *Citharichthys arctifrons.* Young. 46–57 mm.
3 *Monolene sessilicauda.* 114–147 mm.
1 *Phycis regius.* 288 mm.
4 *Peristedium miniatum.* 68–82.
3 *Raia ornata.* (Lengths not given by Garman.)

Station 315.

2 *Læmonema barbatula.* 88–180 mm.
2 *Argyropelecus hemigymnus.* 15–22 mm.
1 larval eel (*Leptocephalus*). 175 mm.

Station 316.

1 *Aphoristia nebulosa.* 85 mm.
1 *Sternoptyx diaphanus.* 19 mm.
2 *Macrurus Bairdii.* 65–77 mm.
3 *Læmonema barbatula.* 81–88 mm.
1 *Hyphalonedrus chalybeius.* 122 mm.
5 *Raia plutonia.* (Size not given.)

Station 317.

1 *Macrurus Bairdii.* 185 mm.
1 *Chalinura simula.* Young. 25 mm.
1 *Raia plutonia.*

Station 321.

6 *Macrurus carminatus.* Fragments.
3 *Phycis regius.* 221–258 mm.
3 *Læmonema barbatula.* 75–120 mm.
1 *Merlucius bilinearis.* 270 mm.
1 *Hyphalonedrus chalybeius.* 70 mm.
1 *Raia plutonia.*

Station 323.

37 *Cyclothone lusca.* 50–64 mm.
1 *Sternoptyx diaphana.* 30 mm.

Station 324.

20 *Cyclothone lusca.* 50–57 mm.
1 *Caranx amblyrhynchus?* 33 mm.

Station 325.

2 *Macrurus Bairdii.* 300–356 mm.
2 *Chalinura simula.* Young??
7 *Dicrolene introniger.* 166–272 mm.
2 *Barathrodemus manatinus.* 150 mm.
1 *Haloporphyrus viola.* 295 mm.
5 *Halosaurus macrochir.* 255–465 mm.
2 *Nettastoma procerum.* 440–700 mm.
12 *Synaphobranchus pinnatus.* 360–475 mm.

STATION 326.

21 *Macrurus Bairdii.* 152–280 mm.
1 *Macrurus carminatus.* 230 mm. Fragmentary.
4 *Dicrolene introniger.* 135–250 mm.
1 *Cottunculus torvus.* 96 mm.
6 *Synaphobranchus pinnatus.* 375–545 mm.

STATION 327.

1 *Onos cimbrius.* Young. 72 mm.
2 *Setarches parmatus.* 51–52 mm.
1 *Peristedium miniatum.* 65 mm.
5 *Hyphalonedrus chalybeius.* 52–58 mm.
1 *Myxine glutinosa.* 282 mm.

STATION 328.

13 *Cyclothone lusca.* 49–59 mm.
1 *Poromitra capito.*

STATION 329.

1 *Glyptocephalus cynoglossus.* Fragments.
1 *Macrurus Bairdii.* 130 mm.
2 *Lycodes Verrillii.* 90–162 mm.
3 *Scopelus Mülleri.* 52–64 mm.
4 *Synaphobranchus pinnatus.* 300–388 mm.

STATION 330.

5 *Cyclothone lusca.* 17–55 mm.
1 *Nemichthys scolopaceus.* 520 mm.

STATION 331.

1 *Saccopharynx flagellum.* Fragmentary.

STATION 332.

2 *Glyptocephalus cynoglossus.* Young. 103 mm.
1 *Macrurus* sp. Unidentifiable, from mutilation.
1 *Macrurus Bairdii.* 92 mm.
6 *Lycodes Verrillii.* 118–147 mm.

STATION 333.

5 *Phycis regius.* 168–225 mm.

STATION 334.

4 *Macrurus Bairdii.* 127–348 mm.
1 *Glyptocephalus cynoglossus.* 282 mm.
1 *Melanostigma gelatinosum.* 103 mm.
3 *Scopelus Mülleri.* 38–52 mm.

Station 335.

6 *Citharichthys arctifrons.* Young. 79–103 mm.
1 *Scyllium retiferum.* 311 mm.

Station 336.

3 *Citharichthys arctifrons.* Young. 75–89.
7 *Phycis Chesteri.* 209–286 mm.
2 *Macrurus Bairdii.* 127–152 mm.

Station 337.

1 *Macrurus Bairdii.* 239 mm.
1 *Haloporphyrus viola.* 300 mm.
1 *Lycodonus mirabilis.* 112+ mm.
2 *Synaphobranchus pinnatus.* 367–374 mm.
1 *Nemichthys scolopaceus.* 510 mm.
1 *Nettastoma procerum.* 190+ mm.

Station 338.

1 *Coryphænoides carapinus.* 225 mm.
1 *Alepocephalus Agassizii.* 274 mm.
1 *Halosaurus macrochir.*

Station 341.

1 *Coryphænoides carapinus.* Unfit to measure.
1 *Bathysaurus Agassizii.* 610 mm.

Station 343.

1 *Glyptocephalus cynoglossus.* 260 mm.
13 *Macrurus Bairdii.* 245–361 mm.
2 *Coryphænoides carapinus.* 196 mm. One not measured.
1 *Cottunculus torvus.* 407 mm.

Station 344.

8 *Merlucius bilinearis.* Young. 25–94 mm.

Station 346.

3 *Phycis chuss.* 340–400 mm.

PLEUROnECTIDÆ.

1. Aphoristia nebulosa, new species.

The extreme length of the type is 85 millimeters. The body is rather slenderer than in other species of the genus; its greatest height (18 mm.) is contained $4\frac{2}{3}$ times in the extreme length. The scales are small, rough, about 120 in a longitudinal series; about 50 in a transverse series. Jaws and snout scaleless. The length of the head (15 mm.) is contained $5\frac{2}{3}$ times in total length. The length of the snout (3 mm.) is $\frac{1}{5}$ that of the head. The eyes are small and close together, being separated by only a single row of scales; the upper eye is very slightly in advance of the lower. The tubular nostril is directly in front of the lower eye, and a little nearer to it than to the tip of snout. The length of the eye (2 mm.) is contained $7\frac{1}{2}$ times in length of head. The angle of the mouth is about in a vertical through the anterior margin of the lower pupil. Teeth feeble, very slender, and rather closely placed, apparently equally developed on the two sides.

The dorsal fin begins at a point slightly behind the eyes; it is connate with the caudal, and contains 119 rays to the middle of the base of the caudal; the rays about the middle of the fin are the longest, their height being a little more than one third that of the body.

The distance of the anal from the snout (20 mm.) is contained $4\frac{1}{4}$ times in extreme length; the longest rays are about the middle of the fin, their length (6 mm.) equalling twice that of the snout. The anal is connate with the caudal, and contains 107 rays, counting to the middle of the base of the latter fin.

The median caudal rays are longest, their length (6 mm.) equalling twice that of the snout.

Pectorals none.

The distance of the ventral from the snout (15 mm.) is contained $5\frac{2}{3}$ times in extreme length. The ventral is separated from the anal by an interspace twice as long as the eye. The number of ventral rays is five, the longest of them being one third as long as the head.

The vent is near the origin of the anal.

Color grayish, everywhere mottled with brown. The median keel on the scales dark and prominent.

Radial formula: D. 119; A. 107; V. 5; P. none.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
316	32° 7′	78° 37′ 30″	229	1

NOTOSEMA, new genus.

Four specimens of a new genus and species, belonging to the Flounder family, were dredged by the Blake at Station 313, off Charleston, S. C., at a depth of seventy-five fathoms.

In general appearance and size this species resembles *Paralichthys quadro-*

cellatus (Gill), Jordan and Gilbert. On account of its elongated ventral fin, the triangular elongation of the anterior rays of the dorsal, and the highly ctenoid character of the scales upon the colored side of the body, it seems necessary to establish for it a new genus.

A genus of pleuronectoid fishes, with elliptical body and pedunculate caudal fin. Mouth moderate in size, and beneath the central axis of the body. Eyes large upon left side, close together, the upper one nearly encroaching upon the profile, the lower slightly in advance of the upper. Teeth in single series in the jaws, about equally developed upon each side, much largest in front; absent on vomer and palatines. Pectoral fins somewhat unequal, that upon the blind side about three fourths as large as its mate. The dorsal fin commences slightly behind the anterior margin of the upper eye, and *the first eight rays are separated into a distinct subdivision of the fin, several of them being much prolonged.*

Caudal fin pedunculate, rounded posteriorly. *Sinistral ventral much elongated.* Scales small, ctenoid on colored side of body. Lateral line prominent, strongly arched over the pectoral, alike on both sides. Gill-rakers moderately numerous, rather stout, subtriangular, pectinate posteriorly. Pseudobranchiæ well developed. Vertebræ 35.

2. Notosema dilecta, new species.

Diagnosis of Species. — Extreme length of specimen described 0.122 mm.

The height of the body is contained twice in its total length, without caudal, and is equal to twice the distance of the origin of the ventral from the snout. The height of the caudal peduncle is one ninth of the standard body length.

The length of the head is two sevenths of the standard length, and three times the diameter of the eye. Width of interorbital area almost imperceptible. Mandible reaching to middle of pupil of lower eye, its length equal to half that of the head. Upper jaw contained twice and one half in length of head.

The dorsal fin, beginning almost over the anterior margin of the eye, is composed of about 68 rays, the longest of which are the second and third, which are contained twice in the greatest height of the body, and which are almost twice as long as the length of the base of the triangular division of the fin to which they belong.

The anal fin is made up of 54–56 simple rays, of which the posterior ones are largest, as they are also in the main portion of the dorsal. It begins close to the vent, at a distance from the snout equal to the length of the elongated sinistral ventral.

The caudal is pedunculate, its middle rays somewhate elongate, giving it a wedge-shaped outline.

The pectoral of the colored side is subtriangular, its length contained five and one half times in the standard length.

The ventrals are composed of six rays, that upon the colored side much produced in its anterior portion, its length more than three times that of its mate.

Color on the left side purplish brown, speckled with dark brown, and with three large ocellated subcircular spots, nearly as large as the eye, with white centre, dark iris, narrow light margin, and a brown encircling outline. They are arranged in the form of an isosceles triangle, the spot marking the apex being upon the lateral line, near the base of the caudal peduncle, the others distant from the lateral line, on either side, a space equal to their own diameters, the lower one nearly reached by the tip of the elongate ventral. On the blind side white. Fins blotched with dark brown.

Radial formula: D. 69; A. 56; P. 11; V. 6; B. 7. Lateral line 48 (in straight portion).

Station	N. Lat.	W. Long.	Fathoms.	Specimens.
313	32° 31′ 50″	78 45′	75	4

3. Monolene sessilicauda, Goode.

Monolene sessilicauda, Goode, Proc. U. S. National Museum, III. 1880, pp. 338, 472. (Nov. 23.)

Three specimens of this species were obtained from Station 314, lat. 32° 24′ N., long. 78° 44′ W., at a depth of 142 fathoms.

The species has also been found only by the U. S. Fish Commission off Newport, R. I., in 115 to 150 fathoms.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
314	32°	78° 44′	142	3

4. Citharichthys arctifrons, Goode.

Citharichthys arctifrons, Goode, *op. cit.*, pp. 341, 472. (Nov. 23.)

Eight young individuals, the longest measuring two inches, were dredged at Station 313, off Charleston, S. C., in 75 fathoms; also, three specimens, badly mutilated, from Station 336, lat. 38° 21′ N., long. 73° 32′ W., in 197 fathoms, and another large one at Station 311, lat. 39° 59′ 30″, long. 70° 12′ W., in 143 fathoms. Other small ones were from Station 314.

The peculiar elongated snout, similar to that of *Macrurus*, is attributable to age.

The species has also been taken by the U. S. Fish Commission off Newport in 83–155 fathoms.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
311	39° 59′ 30″	70° 12′	143	1
313	32° 31′ 50″	78° 45′	75	? 8 juv.
314	32° 24′	78° 44′	142	2
335	38° 22′ 5″	73° 33′ 40″	89	6
336	38° 21′ 50″	73° 32′	197	3 (bad)

5. Glyptocephalus cynoglossus (Linn.), Gill.

Pleuronectes cynoglossus, Linnæus, Syst. Nat., ed. X., I., 1758, p. 269.
Glyptocephalus cynoglossus, Gill, Proc. Acad. Nat. Sci., Phila., 1873, p. 161. Goode and Bean, Proc. U. S. Nat. Mus., I., 1878, p. 21 (with extensive synonymy). Goode, *op. cit.*, p. 475.

A single specimen of the Pole Flounder was obtained from Station 343, Lat. 39° 45′ 20″ N., Long. 70° 55′ W., in 732 fathoms. The occurrence of this species at such immense depths is noteworthy, since the Fish Commission in the same year obtained it at a depth of 120 fathoms, in almost the same latitude, and within one minute of the same longitude (Station 876).

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
343	39° 45′ 40″	70° 55′	732	1
334	38° 20′ 30″	73° 26′ 40″	395	1
332	35° 45′ 30″	74° 48′	263	2 juv.
329	34° 39′ 40″	75° 14′ 40″	603	Frag. of 1

MACRURIDÆ.

6. Macrurus Bairdii, Goode & Bean.

Macrurus Bairdii, Goode & Bean, Amer. Jour. Sci. and Arts, XIV., 1877, pp. 471–473 (Massachusetts Bay). Cat. Fish. Essex Co. and Mass. Bay, 1879, p. 7. Goode, Proc. U. S. Nat. Mus., III., 1880, p. 475.

Numerous specimens were obtained from the following stations : —

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
303	41° 34′ 30″	65° 54′ 30″	306	25
306	41° 32′ 50″	65° 55′	524	12
309	40° 11′ 40″	68° 22′	304	13
312	39° 50′·45″	70° 11′	466	12
316	32° 7′	78° 37′ 30″	229	2 juv.
317	31° 57′	78° 18′ 35″	333	1
325	33° 35′ 20″	76°	647	2
326	33° 42′ 15″	76° 0′ 50″	464	21
329	34° 39′ 40″	75° 14′ 40″	603	1
332	35° 45′ 30″	74° 48′	263	1 juv.
334	38° 20′ 30″	73° 26′ 40″	395	4
336	38° 21′ 50″	73° 32′	197	2
337	38° 20′ 8″	73° 23′ 20″	740	1
343	39° 45′ 40″	70° 55′	732	13

7. Macrurus carminatus, Goode.

Macrurus carminatus, Goode, Proc. U. S. Nat. Mus., III., 1880, pp. 316, 475 (Nov. 23).

The Fish Commission obtained individuals in 1880 in the same region, at depths of 115, 155, 225, and 372 fathoms.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
321	32° 43′ 25″	77° 20′ 30″	233	Fragments of 6
326	33° 42′ 15″	76° 0′ 50″	464	1 very bad

8. Macrurus asper, new species.

The relations of this species appear to be with *M. Bairdii*, from which it differs in (1.) its longer snout, (2.) the location of the vent, which is much farther back, and (3.) the absence of keels upon any of its scales.

The length of the specimen described is 322 millimeters. The body is much stouter than in *M. Bairdii*, its greatest height being contained 6½ times in its length. The scales are small, strong, the free portions covered with vitreous spines arranged in about seven rows; there is no specialization of the central row, as in *M. Bairdii*, though the median spine at the margin of the scale projects most strongly. The number of scales in the lateral line is about the same, there being about 150; there are 7 above and 18 below the line.

Length of head contained 5⅔ times in total length. Width of interorbital area a little greater than horizontal diameter of orbit and length of operculum, and contained 4¼ times in the length of the head. Length of snout about equal to width of interorbital space and about one half the postorbital portion of the head. Snout triangular, depressed, its tip in the axis of the body, and nearly on a level with the lower margin of the eye; its lower surface forming an angle with the body axis, about equal to that formed with same by its upper profile. The superior ridge is pronounced anteriorly, but ends in advance of the concavity in the interorbital space. The lateral ridges are prominent, and continue posteriorly to the eye, with strong angular projections in front of the nostrils. No ridges continued from supraorbital region. Nostrils rather close to the eye. Barbel shorter than the eye. Tip of lower jaw under anterior nostril, cleft of mouth under posterior margin of orbit.

Teeth in the jaws in a very narrow villiform band, the outer series slightly larger: those in lower jaw apparently in single series, moderate.

Distance of first dorsal from snout equal to nearly four times the length of its base, its distance from the anterior margin of the orbit equal to the length of the head. First spine minute; second spine nearly two thirds the length of the head, and when laid down is far from reaching to the origin of the second dorsal. When the fin is erect, its superior margin is nearly at right angles to the plane of the back, and slightly convex. The distance between the two dorsals is twice the length of the base of the first, the second beginning in the perpendicular from the fifth ray of the anal.

The anal is about three times as high as the second dorsal. The vent is under the 30th scale of the lateral line directly in advance of the anal, and at a distance from the ventral considerably greater than the length of that fin, in this respect differing widely from *M. Bairdii.*

Distance of pectoral from snout slightly more than the length of the head. Its length is less than that of the dorsal spine, and slightly more than half its distance from the snout. Its insertion (upper axil) is in the middle line of the body.

Insertion of ventral under that of pectoral, and slightly in advance of that of dorsal. Its first ray is not greatly prolonged, and is about half as long as the distance of the fin from the snout.

Radial formula: 1st D. II, 8–9; 2d D. 105; A. 110; P. 20; V. 10. Scales, 7–150–18.

Color dark reddish brown, the spines upon the scales with a metallic lustre.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
308	41° 24′ 25″	65° 35′ 30″	1242	5
309	40° 11′ 40″	68° 22′	304	1

9. Coryphænoides rupestris, Gunnerus.

Coryphænoides rupestris, Gunnerus, Thjemske. Selsk. Skr. 3, 1765, p. 50. Collett, Norges Fiske, p. 131.

A specimen was taken at station 306. The species has been sent to the National Museum by Gloucester fishermen.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
306	41° 32′ 50″	65° 55′	524	1

10. Coryphænoides carapinus, new species.

Several specimens were obtained from various stations of the "Blake." Most of these had their tails broken off, and all of them were completely denuded of scales, — a natural consequence of their passage in the nets from the ocean depths. By a happy chance, two scales were found attached to the base of the dorsal fin of one of the larger individuals, thus enabling us to determine the general character of the covering of the body. The description of this species is necessarily meagre.

Diagnosis. — Scales 22 to 24 in a transverse series; (the position of the lateral line cannot be determined, but there appear to be four above it;) the scales are oval, membranous, without armature, and rather large. The first ray of the dorsal is very short; the second, compressed anteriorly and serrated, with slender teeth closely appressed and bent upwards. Its length is equal to the length of the head, and is greater than the height of the body. This fin is seated upon a lump-like elevation of the back, and its base is as long as the snout.

The second dorsal begins over the tenth to twelfth anal ray, and at a distance from the end of the first dorsal equal to the length of the head without the snout. The vent is located not far behind the vertical from the end of the first dorsal.

The snout is acute, projecting beyond the mouth, its tip at a distance from the mouth equal to or greater than the diameter of the eye. The bones of the head are very soft and flexible, and its surface is very irregular, there being a very prominent subocular ridge, a prominent ridge extending from the tip of the snout to the middle of the interorbital space, and a curved ridge extending from the upper anterior margin of the orbit, over the cavity containing the nostrils, to a prominent point, at the side of, and slightly posterior to tip of the snout. The barbel is two thirds as long as the eye. The eye is contained in the head four times, and the length of the head in the total length six times.

Radial formula : D. II, 8, 100 ; A. 117 ; V. 10.

The upper jaw extends to the vertical through the posterior margin of the pupil ; its length equals half that of the head without the snout. The mandible extends behind the vertical through the posterior margin of the orbit ; its length is contained three times in the distance from the tip of the snout to the origin of the first dorsal.

The interorbital space is almost twice the diameter of the eye, and is equal to the length of the upper jaw. The preoperculum is crenulate.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
308	41° 24′ 45″	65° 35′ 30″	1242	2
308	"	"	"	2
341	39° 38′ 20″	70° 56′	1241	1
Unknown.				6
338	38° 18′ 40″	73° 18′ 10″	922	1
342	39° 43′	70° 55′ 25″	1002	2

CHALINURA, new genus.

Scales cycloid, fluted longitudinally with slightly radiating striæ. Snout long, broad, truncate, not much produced. Mouth lateral, subterminal, very large. Head without prominent ridges save the subocular ones, and those upon the snout. The suborbital ridge is not joined to the angle of the preoperculum. Teeth in the upper jaw in a villiform band, with those in the outer series much enlarged ; those in lower jaw uniserial, large. No teeth on vomer or palatines. Pseudobranchiæ present, but small. Gill-rakers spiny, depressible, stout, in double series on the anterior arch. Branchiostegal membrane apparently free from the isthmus. Ventrals below the pectorals. Barbel present.

11. **Chalinura simula**, new species.

A single specimen, 458 millimeters in length, was obtained at Station 308. In some respects it resembles the description of *Coryphænoides affinis*, Günther, obtained by H. M. S. "Challenger" at a depth of 1900 fathoms, east of the mouth of the Rio Plata.

The most salient characters are (1.) the very large mouth, (2.) the long obtuse snout, and (3.) the very elongate first ventral ray.

The body is shaped much as in *Coryphænoides*, but is rather stout, its greatest height being contained $6\frac{2}{3}$ times in its total length. The back is somewhat gibbous in profile, the dorsal outline rising quite rapidly from the interorbital region to the origin of the first dorsal, whence it descends almost in a straight line to the end of the tail.

The scales are rather small, cycloid, without armature, but with indications, particularly on the head, of radiating striæ. The number of scales in the lateral line is about 150, about eight rows between the origin of the dorsal and the lateral line, and 17 to 19 between that line and the origin of the anal.

The length of the head is contained about $5\frac{4}{7}$ times in the total length of the body. The width of the interorbital area is a little greater than the long diameter of the orbit, which is equal to that of the snout. The postorbital portion of the head is about three times as long as the diameter of the eye. The length of the operculum is equal to half that of the upper jaw. The preoperculum is emarginate on its posterior limb. The orbit is nearly round, its diameter contained five times in the length of the head. The snout is broad, obtuse, scarcely projecting beyond the mouth; its width nearly as great at the tip as that of the interorbital space or as its own length. The median ridge is very prominent, gibbous in outline when observed laterally; the lateral ridges start out almost at a right angle with the median ridge, and are not continued upon the sides of the head. The suborbitals prominent, forming broad subocular ridges. No supraorbital ridges. Nostrils in front of the middle of the eye, and nearer to its anterior margin than to the tip of the snout. Barbel longer than the diameter of the eye.

Teeth in the upper jaw in a broad villiform band, with the outer series very much enlarged. The lower jaw with the teeth in a single series.

Distance of first dorsal from snout $4\frac{1}{3}$ times the length of its base, its distance from the anterior margin of the orbit about equal to the length of the head. First spine very short, second rather stout and with a simple serration anteriorly, the serræ closely appressed to the spine (the spines all broken at their tips).

The second dorsal begins at a distance from the first about equal to the length of the upper jaw.

The anal is high, its average rays being about three times as long as those in the dorsal. It is inserted slightly behind the perpendicular from the last ray of the first dorsal. The pectoral is inserted over the base of the ventral (its rays are mutilated). The ventral is inserted almost under the pectoral, but very slightly in advance ; its distance from the snout is less than the length of its longest ray, which is prolonged in a filament which extends to the base of the 18th ray of the anal fin.

Radial formula : D. I, IX, 113 ; A. 118 ; P. 20 ; V. 9 ; B. VI.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
308	41° 24′ 45″	65° 35′ 30″	1242	1
317	31° 57′	78° 18′ 35″	333	1 juv. apparently of this species.

Length of adult, 481 millimeters ; of young, about 25 millimeters.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
325	33° 35′ 20″	76°	647	2 juv., and very rotten, probably belonging to the above species.

BROTULIDÆ.

BARATHRODEMUS, new genus.

Diagnosis. — Body brotuliform, much compressed; head considerably compressed with mouth moderate (in the type species extending to the vertical through the middle of the eye). Eye moderate. Head spineless, except a short flattened spine at the upper angle of the operculum. Snout long, projecting far beyond the tip of the upper jaw, its extremity much swollen. Jaws nearly equal in front. Teeth minute in villiform bands on jaws, vomer, and palatines. Barbel none. Anterior pair of nostrils open and situated at the outer angles of the dilated snout, circular, each surrounded with a cluster of mucous tubes. Posterior nostrils over anterior upper margin of orbit. Gill openings wide, membranes not united. Gills four, with a slit behind the fourth : gill laminæ moderate in length. Gill rakers also moderate : not numerous. Pseudobranchiæ absent : a small, separate caudal fin considerably prolonged.

Dorsal and anal fins long. Branchiostegals, eight. Body and head covered with small, thin scales, those on the body scarcely imbricated. Lateral line absent (?). Ventrals reduced each to a single bifid ray, close together, far in front of the pectorals.

12. Barathrodemus manatinus, new species.

Two specimens of this species of *Barathrodemus*, six and a quarter inches in length, were obtained at Station 325, lat. 33° 35′ 20″, long. 76°, at a depth of 647 fathoms.

Description. — Body much compressed. Dorsal and anal outline approaching at an equal angle the horizontal axis. The height of the body is contained $7\frac{1}{2}$ times in its total length without caudal, and $8\frac{1}{3}$ times with caudal included. Scales small ; about 175 rows between the branchial opening and the tail ; and about 34 rows, counting upward and forward obliquely from the origin of the anal to the dorsal line. Lateral line apparently absent.

Head considerably compressed, with rounded upper surface, its length contained about six times in total body length; its width contained 2½ times in its length; its greatest height equal to two thirds its length. Snout slightly longer than the horizontal diameter of the eye, and projecting beyond the tip of the upper jaw a distance equal to the vertical diameter of the eye; much dilated and swollen, the anterior pair of nostrils being situated at the most salient angles; the snout in general form resembling that of a manatee, whence the specific name.

Mouth moderate; its cleft extending to the vertical from the centre of the orbit. Length of the upper jaw equal to twice the horizontal diameter of the eye, and contained 2½ times in the length of the head. The posterior portion of the maxilla is considerably expanded. The maxilla is largely included within a skinny sheath. When the mouth is closed, the lower jaw is entirely included within the upper. Maxilla toothless. Vomer and palatine bands of teeth more than twice as broad as the bands in the intermaxillaries and on the mandible.

Eye elliptical in form. Its vertical diameter two thirds of its horizontal, the latter being equal to the distance from the tip of the snout to the posterior nostril, and contained 5¼ times in the length of the head. The distance of the eye from the dorsal outline is equal to half its horizontal diameter, and to one fifth of the height of the head in a perpendicular through the centre of the eye. Interorbital space rounded: its width equal to the horizontal diameter of the eye.

Dorsal fin inserted in the vertical above the insertion of the pectoral, at a distance from the end of the snout equal to that of the insertion of the pectoral.

Anal inserted under the 21st to 23d dorsal ray, and at a distance from the snout about equal to one third the body length. The height of the dorsal and anal fins is about equal to half the height of the body at the insertion of the anal. Their bases extend almost to the insertion of the caudal.

The caudal is composed of nine rays, the five medial ones almost equal in length, though the tip of the tail is slightly rounded, about equal to the height of the body midway between the branchial opening and the base of the tail.

The ventrals are inserted almost under the middle of the operculum; in length about equal to half the length of the head.

The pectorals are inserted under the origin of the dorsal, and at a distance behind the branchial opening equal to two thirds the vertical diameter of the eye. Their length is equal to the greatest height of the body.

Color, grayish brown. Abdominal region black.

Radial formula: D. 106; A. 86; C. 2 + 5 + 2; P. 18–20; V. $\frac{1}{1}$.

L. lat., ca. 175.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
325	33° 35′ 20″	76°	647	2

DICROLENE, new genus.

Diagnosis. — Body brotuliform, moderately compressed; head somewhat compressed, with mouth large (in the type species extending nearly to the posterior margin of the eye). The tip of the maxillary much dilated. Eye large, placed close to the dorsal profile. Head with supraorbital spines: several strong spines on the preoperculum, and one long spine at the upper angle of the operculum. Snout short, not projecting beyond the upper jaw. Jaws nearly equal in front. Teeth in narrow villiform bands in the jaws on the head of the vomer, and on the palatines. Barbel none. Gill openings wide: membranes not united. Gills four: gill laminæ of moderate length. Gill rakers rather long, not numerous. Pseudobranchiæ absent. A small, separate caudal fin, much prolonged. Dorsal and anal fins long: rays of the pectoral fin arranged in two groups: several of the lower rays being separate and much produced. Ventral fins close together, far in front of the pectorals. Each ventral composed of a single bifid ray. Branchiostegals seven. Body and head covered with small scales. Lateral line close to the base of the dorsal fin, apparently becoming obsolete on the posterior third of the body. Stomach siphonal. Pyloric cæca few, rudimentary. Intestine shorter than body.

13. Dicrolene introniger, new species.

Several specimens of a species of *Dicrolene* were obtained from Stations 325 and 326.

Body moderately compressed, its dorsal and anal outlines approaching at an equal angle the horizontal axis, and tapering to a narrow point, which forms the base of the caudal fin. Scales small, about 110 rows between the branchial opening and the tail, and about 27 transverse rows counting upward and forward obliquely from the origin of the anal. The lateral line rudimentary, running near the base of the dorsal fin at a distance from it less than the diameter of the eye, and apparently becoming obsolete on the posterior third of the body. Body height one sixth of standard length.

Head somewhat compressed, with flattish upper surface, which is encroached upon by the upper margins of the orbit. At the posterior upper margin of each orbit is a strong spine pointing backward and upward; a long sharp spine at the upper angle of the operculum, its exposed portion as long as half the diameter of the eye. Preoperculum, on its lower posterior border, with three equidistant spines much weaker than that of the operculum. Large muciferous cavities in the bones of the head: a row of large cavities extending backward from the upper angle of the orbit, and continuous with those on the lateral line. Mouth large: its cleft considerably longer than half the length of the head, and the maxillary extending behind the vertical from the posterior margin of the orbit. The posterior portion of the maxillary much expanded, its width at the end equal to three fourths the diameter of the eye. Upon its expanded tip are scales. Eye large, one fourth as long as head, and as wide as the interorbital space. Length of head one fifth standard length.

Dorsal fin inserted at a distance from the snout equal to two ninths the length of the body.

Anal inserted under the vertical from the 25th or 26th dorsal ray. The height of the dorsal and anal fins is about equal to the diameter of the eye. Their bases extend almost to the insertion of the caudal.

The caudal is composed of six or seven rays : its length equal to half the distance from the snout to the insertion of the dorsal.

The ventrals inserted almost under, but slightly posterior to, the posterior limb of the preoperculum, in length about equalling the upper jaw.

Pectorals inserted close to the branchial aperture ; the eight lower rays being free and much prolonged, the longest and most anterior being nearly one third as long as the body, and more than three times as long as the contiguous posterior ray of the normally-constructed portion of the fin, which is, however, about equal to the last of the free rays. The free portion of the pectoral being longer, and composed of fewer rays, than the normal portion, the fish has the appearance of bearing two pectoral fins of the same general shape, the lower of which is the longer. The length of the normal portion of the fin is contained about four times in the length of the body.

Radial formula : D. 100 ; A. about 85 ; C. 6 or 7 ; V. $\frac{1}{1}$; P. 19 + 7 or 8. L. lat. 110–120.

Station.	N Lat.	W. Long.	Fathoms.	Specimens.
326	33° 42′ 15″	76° 0′ 50″	464	4
325	33° 35′ 20″	76°	647	7

GADIDÆ.

14. Phycis chuss (Walb.), Gill.

Blennius chuss, Walbaum, Artedi, 1792, p. 186.
Phycis chuss, Gill, Proc. Acad. Nat. Sci. Phila., 1862, p. 237.

This species occurred at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
311	39° 59′ 30″	70° 12′	143	1
346	40° 25′ 35″	71° 10′ 30″	44	3

15. Phycis tenuis (Mitch.), Dekay.

Gadus tenuis, Mitchill, Trans. Lit. & Phil. Soc. N. Y., 1814, p. 372.
Phycis tenuis, DeKay, Zoöl. New York, Fishes, 1842, p. 293.

Taken in the following locality.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
309	40° 11′ 40″	68° 22′	304	1

16. Phycis regius (Walb.), Jordan & Gilbert.

Blennius regius, Walbaum, Artedi, 1792, p. 186.
Urophycis regius, Gill, Proc. Acad. Nat. Sci. Phila., 1863, p. 240.
Phycis regius, Jordan & Gilbert, Proc. U. S. Nat. Mus., I., 1878, p. 371. Goode & Bean, Cat. Fish. Essex Co. and Mass. Bay, 1879, p. 8; Bean, Proc. U. S. Nat. Mus., III. p. 70; Goode, ibid., p. 476 (with synonymy).

Specimens of this beautiful Hake were obtained at depths of 142 and 233 fathoms. Prof. Agassiz and the officers of the "Blake" had their attention forcibly attracted to a singular power of emitting electric shocks possessed by this fish. This peculiarity has never been noticed in this species save in deep water. The attention of observers is called to this interesting point.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
333	35° 45′ 25″	74° 50′ 30″	65	5
314	32° 24′	78° 44′	142	1
321	32° 43′ 25″	77° 20′ 30″	233	3

17. Phycis Chesteri, Goode & Bean.

Phycis Chesteri, Goode & Bean, Proc. U. S. Nat. Mus., I., 1878, p. 256; Cat. Fish. Essex Co. and Mass. Bay, 1879, p. 8; Goode, Proc. U. S. Nat. Mus., III. p. 476.

Numerous specimens of this fish were taken at various depths. These collections confirm the view expressed after a study of the collections made by the Fish Commission in the same year; namely, that *Phycis Chesteri* and *Macrurus Bairdii* appear to be the most abundant fishes in the continental slope from 140 to 500 fathoms, occurring in immense numbers and breeding copiously.

Following is a list of the stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
Unknown.				5
336	38° 21′ 50″	73° 32′	197	7
303	41° 34′ 30″	65° 54′ 30″	306	4

LÆMONEMA, Günther.

Læmonema, Günther, Cat. Fish. Brit. Mus., IV., p. 356, 1862.

18. Læmonema barbatula, new species.

Head contained in body (without caudal) $4\frac{2}{3}$ times; height of body $4\frac{1}{2}$ times. Diameter of orbit in length of head three times, upper jaw a little more than twice. Barbel half as long as the diameter of the eye. Vent situated under the sixth or seventh ray of second dorsal. Distance of first dorsal from snout equal to one fourth standard length of body. The base of the first dorsal is half as long as the middle caudal rays ; that of the second, slightly more than three times the length of the head. The first dorsal is composed of five rays, the first of which is elongate, three times as long as the middle caudal rays : it extends to the base of the twenty-fourth ray of the second dorsal. Anal fin inserted at a distance from the tip of the snout equal to twice the length of the head, its distance from the insertion of the ventrals being equal to the length of the head. The length of the ventrals is equal to that of the pectorals, their tips not extending to the vent.

Scales small, very thin, deciduous, crowded anteriorly. Lateral line not well defined on the posterior part of the body.

Radial formula : B. VII ; D. 5–63 ; A. 59 ; P. 19 ; V. 2.

Scales 13–140–31.

Color similar to that of the various species of *Phycis ;* the dorsal and anal fins have narrow black margins.

The length of the first dorsal ray is very variable in individuals, being shorter in younger specimens.

This species differs from *L. Yarrellii* by its much smaller scales, and from *L. robustum* by the greater number of rays in the dorsal and anal fins, and its much shorter ventrals.

Specimens of this species were obtained at the following stations of the steamer "Blake."

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
321	32° 43′ 25″	77° 20′ 30″	233	1 and part of 1
315	32° 18′ 20″	78° 43′	225	2
316	32° 7′	78° 37′ 30″	229	3

A single specimen was also obtained by the Fish Commission steamer "Fish Hawk" in Lat. 38° 35′ N., Long. 73° 13′ W., at a depth of 312 fathoms, Oct. 10, 1881 (U. S. Nat. Mus., No. 29,046).

MEASUREMENTS.

	Millimeters.
Extreme length	178
Length to base of middle caudal rays	160
Body. Greatest height	36
Greatest width	18
Height at ventrals	32
Least height of tail	4
Head. Greatest length	33
Greatest width	20
Width of interorbital area	7
Length of snout	7
Length of upper jaw	15
Length of mandible	17

Distance from snout to orbit	9
Diameter of orbit	11
Dorsal (*first*). Distance from snout	40
Length of base	9
Length of longest ray	54
(*second*). Length of base	105
Length of first ray	14
Length of longest ray	17
Anal. Distance from snout	65
Length of base	86
Length of first ray	7
Length of longest ray	16
Length of last ray	3
Caudal. Length of middle rays	18
Pectoral. Distance from snout	36
Length	25
Ventral. Distance from snout	30
Length	25
Branchiostegals	VII
Dorsal	5–63
Anal	59
Caudal	
Pectoral	19
Ventral	2
Number of scales in lateral line	ca. 140
Number of transverse rows above lateral line	13
Number of transverse rows below lateral line	31

19. Haloporphyrus viola, Goode & Bean.

Haloporphyrus viola, Goode & Bean, Proc. U. S. Nat. Mus., I. pp. 257–260, Dec. 17, 1878.

Specimens were obtained at the following stations.

Station	N. Lat.	W. Long.	Fathoms.	Specimens.
305	41° 33′ 15″	65° 51′ 25″	810	1
308	41° 24′ 25″	65° 35′ 30″	1242	5
306	41° 32′ 50″	65° 55′	524	13
325	33° 35′ 20″	76°	647	1
312	39° 50′ 45″	70° 11′	466	2
Unknown.				1
337	38° 20′ 8″	73° 23′ 20″	740	1
303	41° 34′ 30″	65° 54′ 30″	306	1

20. Onos cimbrius (Linn.), Goode & Bean.

Gadus cimbrius, Linn., Syst. Nat., ed. XII., 1766, p. 440.
Onos cimbrius, Goode & Bean, Proc. U. S. Nat. Mus., 1. p. 349, Feb. 14, 1879.

A single specimen, 70 mm. long, of a species of *Onos*, apparently *O. cimbrius*, was taken at Station 327. It was in fragments when received.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
327	34° 0′ 30″	76° 10′ 30″	178	1 bad.

21. Merlucius bilinearis (Mitch.), Gill.

Stomodon bilinearis, Mitchill, Rep. Fish. N. Y., 1814, p. 7.
Merlucius bilinearis, Gill, Cat. Fish. E. Coast N. A., 1861, p. 48.

Specimens mostly young were obtained at several stations enumerated below. A reference to the list of stations will show that the very young, not more than 25 millimeters in length, were secured.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
313	32° 31′ 50″	78° 45′	75	2
311	39° 59′ 30″	70° 12′	143	1
321	32° 43′ 25″	77° 20′ 30″	233	1
344	40° 1′	70° 58′	129	8 juv.

LYCODIDÆ.

22. Lycodes Verrillii, Goode & Bean.

Lycodes Verrillii, Goode & Bean, Amer. Jour. Sci. and Arts, Vol. XIV., Dec., 1877, pp. 474–476.

This species was collected at the three following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	40° 11′ 40″	68° 22′	304	2
329	34° 39′ 40″	75° 14′ 40″	603	2
332	35° 45′ 30″	74° 48′	263	6

23. Lycodes paxilloides, new species.

This species resembles *Lycodes paxillus*, Goode & Bean, in many respects, but differs markedly in the smaller mouth and less prominent cheeks.

Diagnosis. — The length of the head is contained about eight times in the total length. The greatest height of the body is about half the length of the head. The dorsal begins over the end of the extended pectoral : its distance from the tip of the snout is contained 4⅔ times in the total length; that of the anal from the snout, 3⅓ times. The vent is immediately in front of the anal. The length of the pectoral equals one half that of the head, or a little more. The distance of the ventral from the snout is contained 8½ times in the total length. The length of the ventral is scarcely more than that of the pupil. The interorbital space (on the skull) is about one fourth the length of the snout, which is about equal to that of the eye, which is contained 3½ times in the length of the head. The tubular nostril is much nearer the tip of the snout than to the eye. The scales are very small, present everywhere except on the head and the pectorals, extending almost out to the margin of the vertical fins. Dorsal (with half of caudal) 118 rays; anal (with half of caudal) 110. Pectoral 16, ventral 3. Color light brown, the head somewhat darker.

Specimens were obtained at the following places.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	40° 11′ 40″	68° 22′	304	2
312	39° 50′ 45″	70° 11′	466	1

LYCODONUS, new genus.

This genus is in nearly every particular like *Lycodes*, from which, however, it is distinguished by the peculiar structure of the dorsal and anal fins.

Diagnosis. — Body blenniform, elongate. Scales small, circular, imbedded in the skin. Lateral line very short, posteriorly obsolete. Eye moderate. Jaws without fringes. Upper jaw longer than lower. Fin rays soft, articulated; *those of the dorsal and anal fins supported laterally, each by a pair of sculptured ectodermal scutes or plates.* Caudal distinct; *not fully connate with dorsal* and anal, few-rayed. Ventrals present, jugular each composed of a few slender deeply cleft articulated rays. Gill opening rather narrow. Branchiostegal membranes broadly joined to the isthmus. Teeth as in *Lycodes.* Pseudobranchiæ apparently present. Branchiostegals apparently five. Gill arches four. Gill rakers rudimentary, in moderate number. Air bladder and pyloric cæca apparently absent.

Lycodonus mirabilis, new species.

The body is shaped much as in *Lycodes Verrillii;* its greatest height, at origin of dorsal, contained about eighteen times in the length of the body. Scales as in *Lycodes*, the scales not extending out upon the fins. The head and nape are also scaleless. Lateral line apparently obsolete posteriorly, not extending back of the extremity of the pectoral.

The length of the head is contained about seven times in the entire length. The diameter of the eye is contained 2½ times in the length of the head, and is about equal to the postorbital portion of the head. The eye is placed high, the width of the interorbital space being less than the diameter of the pupil, and contained $3\frac{1}{2}$ times in the long diameter of the eye. Nostrils immediately in front of the eye. Teeth as in *Lycodes*. The maxilla extends to the vertical through the anterior margin of the pupil ; the mandible, to a little behind the vertical through the posterior margin of the pupil.

The dorsal fin is inserted slightly behind the vertical through the base of the pectoral ; the portion of the fin present in the mutilated specimen before us contains 80 articulated rays. The first ten or eleven scutes do not support rays, but whether rays were originally present or not cannot now be ascertained. The longest dorsal ray is about equal to the longest anal ray, its length being contained about three times in that of the head. The distance of the vent from the snout is twice the length of the head ; the anal begins immediately behind the vent ; it consists at present of about 70 articulated rays. The caudal rays extend beyond the tips of the ultimate dorsal and anal rays ; they are about 9 in number.

The distance of the ventral from the snout is equal to twice the length of the upper jaw ; the middle ventral ray is the longest, it being half as long as the postorbital part of the head.

The length of the pectoral equals three times that of the snout.

Radial formula : D. 80+ ; A. 70+ ; C. 9 ; P. 18 ; V. 3.

The single mutilated specimen was from Station 337. It measured 112 millimeters in its imperfect condition.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
337	38° 20′ 8″	73° 23′ 20″	740	1

25. Melanostigma gelatinosum, Günther.

Melanostigma gelatinosum, Günther, Proc. Zoöl. Soc. London, 1881, Part 1, Jan. 4, p. 21 (genus, p. 20), Pl. II. fig. A.

A single greatly mutilated specimen, 103 mm. long, was obtained.

It has since been taken by the U. S. Fish Commission, in the deep water off Martha's Vineyard.

This species was described from a specimen obtained, January 16, 1880, by Dr. Coppinger, of H. M. S. Steamer "Alert," at Tilly Bay in the Straits of Magellan, in 24 fathoms. Dr. Günther remarks (*op. cit.*, p. 21), "The fish is evidently habitually living at a greater depth than that at which Dr. Coppinger happened to obtain the single specimen in his collection." This does not seem to us to be necessarily a logical conclusion, since, as is well known to those who have studied the distribution of deep-sea forms in the Western Atlantic, those which are found at great depths in temperate seas are shore inhabitants in seas near the poles.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen
334	38° 20′ 30″	73° 26′ 40″	395	1 (fragments)

TRIGLIDÆ.

26. Prionotus alatus, new species.

A single specimen of a new species of *Prionotus* was obtained off Charleston, S. C., in the same haul with the pleuronectoid described above under the name *Notosema dilecta.* This species belongs to the group referred by Jordan to the subgenus *Ornichthys* of Swainson.

Description. — A *Prionotus* with the body normal in form, rather robust: its greatest height equal to one fourth its length without caudal, and nearly equal to one fifth of the total length; its greatest width one fifth of its greatest length without caudal; the least height of tail contained twelve times, or nearly so, in the standard body length, and three times in the height of the body.

Scales small and much pectinate, there being in the lateral line about one hundred vertical rows of scales, about fifty of which are tube-bearing and specialized. The number of rows, counting diagonally around the body from the origin of the anal, is twenty-one below and seven above the lateral line. The length of the head to the tip of the preopercular spine is contained two and a half times in the standard body length, and very little more than three times in the total length. The width of the head is equal to its height. The upper limb of the orbit encroaches upon the upper profile of the head, and the centre of the pupil is equidistant from the tip of the snout and the tip of the prolonged preopercular spine. The length of the snout, measured obliquely from the anterior margin of the orbit, is equal to that of the postorbital portion of the head to the end of the opercular spine. At the lower angle of the preoperculum is a robust spine, curving slightly upwards, the length of which is equal to that of the first dorsal ray. This spine is serrated upon its outer edge, and has a small spine at its base, which is also serrated. The tip of the spine extends to the perpendicular from the centre of the interspace between the third and fourth dorsal spines; while that of the humeral spine extends to the perpendicular from the interspace between the fourth and fifth, and that of the opercular, to the perpendicular from the centre of the base of the third. There is a strong scapular spine, which extends back to the posterior edge of the second dorsal spine.

The length of the upper jaw is equal to one third that of the head. The palatine teeth are in short feeble bands, hardly perceptible even with a strong magnifying-glass. Gill rakers, six in number, besides several rudimentary ones, five being below the angle, and the longest equal in length to one third the diameter of the eye.

The first dorsal fin is inserted above the tip of the upper opercular spine, and at a distance from the snout equal to twice the length of the fourth dorsal spine. The height of the first dorsal spine, which is equal to that of the third, and slightly less than that of the second, equals half the length of the head.

Its anterior margin is strongly serrated, while those of the second and third spines are less markedly so. The length of base of first dorsal equals the greatest height of body: the distance between its insertion and that of the second dorsal fin is equal to the length of the longest and superior detached pectoral ray. The second dorsal fin is inserted in the perpendicular over the interspace between the second and third anal rays: the length of its longest ray equals twice the least height of tail, and the length of its base equals the greatest length of the ventral rays. Its first ray is conspicuously serrated on its anterior edge.

The insertion of the anal fin is in the perpendicular below the end of the first dorsal fin: the length of its longest ray is equal to half that of the middle caudal rays.

The caudal is truncated, very slightly emarginate.

The pectoral is very peculiar in structure, its longest ray, the 9th, reaching to the base of the caudal rays, and equal in length to four times that of the fourth dorsal spine. The 10th ray is a little bit shorter, extending nearly to the end of the soft dorsal. The 11th, 12th, and 13th rays are graduated, decreasing in regular proportion, the 13th being less than one fourth as long as the 10th. The 8th is about midway between the 10th and 11th: the 1st is slightly longer than the 12th, and those intermediate between the 1st and the 8th are graduated in length, so as to form a rounded outline for the anterior, or upper, portion of the fin. The pectoral appendages are slender, the third being slightly greater in length than the 13th ray, being two thirds as long as the first, while the second is intermediate between the other two.

The ventral is inserted directly under the base of the pectoral appendages: its first spine about equal in length to the preopercular spine from the base of the supplemental spines; its longest, the third and fourth, exactly equal in length to the base of the second dorsal.

Color, brownish above, with about four indistinct transverse band-like blotches, one of which is on the base of the caudal; whitish beneath. Vertical fins uniform, the tips of the caudal rays blackish, with two indistinct cloud-like bands in advance of the terminal band thus formed. A black blotch, with whitish anterior margin on the membrane between the fourth and fifth dorsal spines; a very inconspicuous blackish spot on the membrane between the fifth and sixth; others still less conspicuous on the succeeding interspaces. The pectoral blotched and clouded with blackish brown and white.

Radial formula: D. X, 12; A. 11; C. 3 — 7 + 5 — 4; P. 13 + 3; V. I, 5.

L. lat. about 100. Tube-bearing scales, about 50.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
313	32° 31′ 50″	78° 45′	75	1

AGONIDÆ.

27. Peristedium miniatum, Goode.

Peristedium miniatum, Goode, Proc. U. S. Nat. Mus., III. pp. 349, 350, Nov. 23, 1880.

Young individuals were trawled at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
327	34° 0′ 30″	76° 10′ 30″	178	1
314	32° 24′	78° 44′	142	4

COTTIDÆ.

28. Icelus uncinatus (Reinhardt), Kröyer.

Cottus uncinatus, Reinhardt, "Overs. Kgl. D. Vid. Selsk. Naturv. Math. Afh. 6 Del., p. xliv., Copenhagen, 1837 (1833–34)."
Icelus uncinatus, Kröyer, Naturh. Tidssk., 2ser., B. I., p. 263, 1844.
Centridermichthys uncinatus, Günther, Catalogue of the Fishes in the British Museum, II., 1860, p. 172. Collett, Norske Nordhavs-Expedition, 1876-78, Fiske, p. 29, pl. 1, fig. 7.

A single specimen, much mutilated, was taken at Station 303.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
303	41° 34′ 30″	65° 54′ 30″	306	1

29. Cottunculus microps, Collett.

Cottunculus microps, Collett, Norges Fiske, Appendix to Forh. Vidensk. Selskab., Christiania, 1874, p. 20, pl. 1, figs. 1–3. Norske Nordhavs-Expedition, Fiske, 1880, p. 18, pl. 1, figs. 5, 6.

Taken at only one station. Two small examples secured.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
310	39° 59′ 16″	70° 18′ 30″	260	2

30. Cottunculus torvus, Goode, new species.

Cottunculus torvus, Goode, Proc. U. S. Nat. Mus., III. p. 479 (name only).

Diagnosis. — Head and body smooth, scaleless, covered with a tough lax skin. The length of the head is nearly one third of the extreme length of the body including the caudal; its greatest height, one fourth of the body without the caudal. The greatest width of the head is twice the length of the maxilla. The distance of the vent from the insertion of the anal equals the length of the maxilla. The eye is close to the dorsal profile. The length of the orbit is about equal to that of the snout, and is contained about four and a half times in the greatest length of the head. The intermaxillary is long and slender, its length contained slightly more than three times in the distance from the tip of the snout to the insertion of the first dorsal (three and one third times in the length of the head). The maxilla is very slender, except in its posterior third, where it is considerably expanded. The mandible is very stout, posteriorly widened, its length contained nearly two and one third times in that of the head. Teeth in broad villiform bands on the intermaxillary and the mandible. Two short separate similar bands on the vomer. None on the palatines.

Head armed with blunt spines, as in *C. microps.*

The distance of the dorsal from the tip of the snout is nearly equal to one third of the total length, caudal included. It consists of six spines and seventeen rays.

The anal fin is located midway between the tip of the snout and the end of the caudal fin ; it consists of thirteen rays.

The length of the upper pectoral rays is equal to that of the postorbital portions of the head. The pectoral rays diminish rapidly in size, the lowest being exceedingly short. The number of rays is twenty-two. The distance of the ventral from the tip of the snout is one third of the total length without the caudal. The length of the free portion of the ventral equals that of the eye The fin consists of one spine and three rays.

The caudal consists of ten developed rays.

Color light brown, the fins somewhat darker.

This species was first noticed in the Fish Commission collections of 1880, and was mentioned by name in a paper published in that year by Mr. Goode. No description accompanied this name, and the author of it has no excuse to offer for following a practice which is so pernicious and indefensible.

Specimens were obtained as follows : —

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
306	41° 32′ 50″	65° 55′	524	3
343	39° 45′ 50″	70° 55′	732	1
326	33° 42′ 15″	76° 0′ 50″	464	1

SCORPÆNIDÆ.

31. Setarches parmatus, Goode.

Setarches parmatus, Goode, Proc. U. S. Nat. Mus., III. pp. 480, 481, Feb. 16, 1881.

Two specimens, respectively 53 mm. and 52 mm. long, were taken at Station 327, Lat. 34° 0′ 30″, Long. 76° 10′ 30″, at a depth of 178 fathoms. These specimens and the type of the species are the only three examples known.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
327	34° 0′ 30″	76° 10′ 30″	178	2

32. **Sebastoplus dactylopterus** (De la Roche), Gill.

Scorpæna dactyloptera, De la Roche, Ann. Mus., XIII., pl. 22, fig. 2 (*fide* Günther, Cat. Fish. Brit. Mus., II. p. 99.

Sebastoplus dactylopterus, Gill, MS.

A single young specimen was taken. The U. S. Fish Commission has since secured many young and adult.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
311	39° 59′ 30″	70° 12′	143	1

CARANGIDÆ.

33. **Caranx amblyrhynchus**, Cuv. & Val.?

Caranx amblyrhynchus, Cuv. & Val., Hist. Nat. Poiss., Vol. IX. p. 100, pl. 248.

A single young individual, apparently of this species (D. VIII, i, 27 ; A. II, i, 24 ; V. I, 5 ; L. lat. ca. 39), was taken at Station 324 ; its length is 33 mm. In all probability the fish was caught near the surface, while the trawl was on its way up, and not on the bottom.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
324	33° 27′ 20″	75° 53′ 30″	1386	1

BERYCIDÆ.

POROMITRA, new genus.

A single individual, 1¼ inches long, was obtained at Station 328, and another one of about the same length is in the collection without locality. The species comes to us in such a dilapidated condition, that it is impossible to make a satisfactory diagnosis of its characters. It seems to differ widely from anything heretofore described. As it is, we simply describe it under a new generic name, and at present shall refer it to *Berycidæ*, to which, as we now view it, it appears to be related.

Provisional Diagnosis. — Body short, compressed, scopeliform, covered with thin cycloid scales. Head very large, nearly half the entire length of the fish to base of caudal, with scales upon cheeks, suboperculum, and probably elsewhere. No barbel. Mouth very large, the lower jaw projecting. Margin of upper jaw composed of a short intermaxillary and a long maxillary. Teeth cardiform, numerous, very small, on the intermaxillaries and mandibles. None discovered on maxillaries, palatines, or vomer. Opercular apparatus complete.

Dorsal fin in the middle of the body, its origin not far behind that of the ventrals, the spinous and soft portions subequal in length. Anal much shorter than dorsal, its middle under the end of the dorsal, or nearly so. Pseudobranchiæ present. Gill openings very wide, separate.

34. Poromitra capito, new species.

The height of the body is two sevenths of its length to base of caudal rays; its width about one half its height. Scales as large as the pupil, with concentric striæ, about twenty-four in the lateral line, and about ten in the transverse series.

Head about two fifths of standard length, somewhat resembling in appearance that of *Alepocephalus Bairdii.* The eye is large, circular, located normally. The length of the upper jaw is three sevenths that of the head; that of the lower jaw about one half. The end of the maxillary is nearly in the perpendicular from the posterior limb of the pupil. The length of the snout is about equal to the least diameter of the eye. The distance from the limb of the preoperculum to the end of the opercular flap is equal to that from the tip of the snout to the posterior margin of the orbit. Teeth as described in generic diagnosis. Dorsal fin inserted midway between tip of snout and origin of middle caudal rays. The fin is mutilated and its outline cannot be determined; it is composed of seven or eight spines and six soft rays, and the length of its base is nearly equal to the height of the body at its insertion.

The anal fin is inserted in the perpendicular from the base of the eighth dorsal ray. It is composed of nine rays, and the length of its base is half that of the dorsal base.

The pectoral is inserted far below the axis of the body, and with a single scale between its axil and the branchial opening. Its length is twice the distance of its insertion from the snout.

The ventral is minute (apparently, and is inserted in advance of the pectoral); it has apparently seven or eight rays.

The caudal is mutilated, but apparently composed of fifteen rays.

Radial formula: D. VII or VIII, 6; A. 9; V. 7 or 8; P. 12; C. 15.

Two examples were secured, — one from an unknown locality. The list follows.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
No locality slip.				1
328	34° 28′ 25″	75° 22′ 50″	1632	1

SYNODONTIDÆ.

BATHYSAURUS, Günther.

Bathysaurus, Günther, Ann. and Mag. Nat Hist., Aug. 1878, p. 181.

35. Bathysaurus Agassizii, new species.

Body elongate, subcylindrical, with depressed head and tapering tail, its greatest height contained seven times in its standard length, and eight times in the length to tip of upper caudal lobe: its greatest width nine times in standard length ; its height at the origin of the anal about half its greatest height ; length of caudal peduncle equal to greatest height of body.

Scales irregularly ovate, with the free portion convex, thin, cycloid, leathery, deciduous, those in middle of body with a vertical diameter nearly equal to that of the pupil, those of lateral line with posterior margin truncate. In the lateral line, which extends upon the caudal fin, descending below the median line of the body near the origin of this fin, are seventy-eight specialized scales, larger than those of the body. Between the dorsal fin and the lateral line are about eight rows of scales ; between the latter and the anal fin are about the same number.

Head twice as long as the greatest height of the body, strongly depressed, alligator-like, naked except upon the cheeks and a small area on the occiput, with strong nasal and interorbital ridges. The greatest width is somewhat more than half its greatest length, the width of interorbital area nearly equal to half that of head, and one fourth the length of the lower jaw. The length of the snout is equal to twice the horizontal diameter of the eye. The anterior nostrils are situated midway between the tip of the snout and the anterior margin of the orbit. The cleft of the mouth is enormous, its angle posterior to the eye by a distance about equal to the width of the interorbital space. The length of the upper jaw equals one sixth of the standard body length ; that of the lower jaw, one fifth. The margin of the upper jaw (formed by the intermaxillary only) is armed with two irregular rows of depressible teeth, some of which are barbed ; those in the inner row are much the largest, many of them being two thirds as long as the horizontal diameter of the pupil and twice as long as those in the outer series. The lower jaws are enormously strong, and broad, flattened below, the width measured on the under surface of the head equal to two thirds the width of the broad interorbital space. The lower jaw projects outside of the upper jaw at the sides a distance apparently equal to half its width, and considerably in front ; the lower jaws are thickly studded with depressible teeth, many of them, especially the larger inner ones, strongly barbed, those in front claw-like, recurved. On the palatines, three rows of teeth, the middle ones very much enlarged and most of them strongly barbed, — these being the largest of all the teeth. On the tongue a few weaker teeth, and groups of similar teeth upon the vomer.

Gill laminæ, gill rakers, and pseudobranchiæ, as described by Dr. Günther in the diagnosis of the genus.

The dorsal fin contains seventeen rays, and is inserted at a distance from the tip of the snout equal to the length of its own base, and slightly greater than one third of the standard body length. The fourth or longest ray is equal in length to the greatest height of the body. The first ray is a rudiment ; the second is nearly half as long as the third ; the third slightly shorter than the fourth ; after the fourth the rays diminish rapidly in length to the ninth, which is about half as long as the lower jaw, and subsequent to which the diminution is gradual : the last ray is about as long as the first.

There is no adipose dorsal; if ever present, it was obliterated before the specimen came into our possession.

The anal fin contains eleven rays, and is inserted considerably behind the vertical from the termination of the dorsal, — at a distance equal to the horizontal diameter of the eye; the length of its base is equal to half that of the dorsal, the length of its longest ray (the third) equal to that of the eighth of the dorsal.

The caudal is slightly forked, its middle rays two thirds as long as those in the upper lobe, and about equal to the seventh dorsal ray.

The pectoral fin consists of fifteen rays, is inserted under the fourth scale of the lateral line, and at a distance in front of the dorsal equal to half the greatest height of the body. Its length is equal to that of the lower jaw, and the seventh ray is prolonged to a length equal to that of the head, its tip extending to the perpendicular from the twelfth dorsal ray.

The ventral is composed of eight rays, and its base is almost entirely in advance of the perpendicular from the origin of the dorsal: its length equals half that of the head. The two ventrals are far apart.

Radial formula: B. 10 (?); D. 17; A. 11; C. 19; P. 15; A. 8. Scales 8, 78, 8.

Color brownish, the inside of the branchiostegal flap bluish black.

A single specimen, about two feet in total length, a female, full of nearly mature eggs, was taken at a depth of 647 fathoms, at Station 325, in Lat. 33° 35′ 20″ N., Long. 76° W.

MEASUREMENTS.

	Millimeters.
Length to base of caudal	540
Length to end of middle caudal rays	610
Body. Greatest height	76
Greatest width	58
Height at ventrals	76
Least height of tail	25
Head. Greatest length	137
Greatest width	62
Width of interorbital area	27
Length of snout	40
Length of maxillary	89
Length of mandible	108
Diameter of orbit	20
Dorsal. Distance from snout	191
Length of base	171
Length of first ray	5
Length of longest ray (4th)	78
Anal. Distance from snout	380
Length of base	85
Length of longest ray	56

Pectoral. Distance from snout	144
Length	105
Length of prolonged ray	132
Ventral. Distance from snout	175
Length	70
Branchiostegals	X (?)
Dorsal	17
Anal	11
Caudal	19
Pectoral	15
Ventral	8
Number of scales in lateral line	78
Number of transverse rows above lateral line	8
Number of transverse rows below lateral line	8

ALEPOCEPHALIDÆ.

36. Alepocephalus Agassizii, new species.

A single specimen of *Alepocephalus* was obtained at Station 338, in 922 fathoms, Lat. 38° 18′ 40″ N., Long. 73° 18′ 10″ W.

This is the fourth species of the genus which has, to date, come up for description: the first, *A. rostratus*, having been described by Risso from the Mediterranean in 1820; the second, *A. niger*, from north of Australia, at a depth of 1,400 fathoms, obtained by H. M. S. "Challenger," and described by Günther in 1878; the third, *A. Bairdii*, from the Grand Banks of Newfoundland, at a depth of 200 fathoms, described by us in 1879. The former American species having been named in honor of the Director of the U. S. National Museum, we propose to dedicate the one now under consideration to the Curator of the Museum of Comparative Zoölogy, under the name *Alepocephalus Agassizii.*

Diagnosis. — Body slightly less elongate than in *A. Bairdii*, its height being contained very slightly more than five times in its length to origin of middle caudal rays, somewhat compressed, its width being about half its height. The least height of the tail is contained twelve times in the length of the body.

Scales apparently ovate-lanceolate, parchment-like, smaller than in *A. Bairdii:* the specimen is almost denuded of scales, and their arrangement in the drawing has been in part made out from their impressions upon the skin. There are ninety scales in the lateral line, ten between lateral line and origin of dorsal, eleven between same and origin of anal. The base of the dorsal is squamose, the anal slightly so, but probably less than in *A. Bairdii.*

Head somewhat compressed, snout conically elongate, the lower jaw slightly produced. Its length is contained three times in the length of the body (in *A. Bairdii*, 4⅓), slightly exceeding twice the length of the lower jaw, and four times the least height of the tail (in *A. Bairdii*, less than three). Width of head slightly less than length of operculum, and 9½ times in length of body (12 in *A. Bairdii*).

Length of snout half that of mandible, which is one sixth of total length (1/9 in *A. Bairdii*). Diameter of orbit in total length of body 10½ times (18 in *A. Bairdii*), 3½ in head (about 4⅓ in *A. Bairdii*).

The insertion of the dorsal is immediately above the vent; the distance of its origin from the base of middle caudal rays equal to one third of distance from same to anterior margin of orbit, and at a distance from the snout much greater than two thirds the total length of body (about equal in *A. Bairdii*). The length of its base is equal to one eighth of total length.

The origin of the anal is under the second ray of the dorsal; its length of base is slightly more than one seventh of the body length, and is equal to the height of the body at the vent.

The ends of the dorsal, anal, and caudal rays are broken off in the specimen before us.

Distance of pectoral from snout, equal to ⅓ of the body length (slightly more than ¼ in *A. Bairdii*) and 4½ times least height of tail (3 in *A. Bairdii*). Its length equal to the diameter of orbit and contained 10½ times in total length (10 in *A. Bairdii*). The origin of the pectoral is close behind the end of the opercular flap, while in *A. Bairdii* it is separated therefrom by four rows of scales.

Distance of ventral from snout considerably less than twice the length of the head. Its length, probably, about one sixth that of the head.

Radial formula: D. 15; A. 17; C. 19; P. 11; V. 1, 5?

L. lat. 90.

Dentition as in *A. Bairdii.*

Color dark, head and fins nearly black.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
338	38° 18′ 40″	73° 18′ 10″	922	1

HALOSAURIDÆ.

37. Halosaurus macrochir, Günther.

Halosaurus macrochir, Günther, Ann. and Mag. Nat. Hist., 5th Ser., II., 1878, p. 251.

H. macrochir was described by Dr. Günther from specimens obtained by H. M. S. "Challenger," in the Atlantic, at a depth of 1090 fathoms, and midway between the Cape of Good Hope and Kerguelen's Land, at a depth of 1375 fathoms.

Specimens were obtained by the "Blake" at the following stations: —

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
308	41° 24′ 25″	65° 35′ 30″	1242	1
325	33° 35′ 20″	76°	647	5

STOMIATIDÆ.

38. Stomias ferox, Reinhardt.

Stomias ferox, Reinhardt, Vid. Selsk. Nat. og Math., Afhandl. X. p. lxxviii.

A single specimen was obtained at each of the two following stations : —

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	40° 11′ 40″	68° 22′	304	1
306	41° 32′ 50″	65° 55′	524	1

STERNOPTYCHIDÆ.

39. Sternoptyx diaphana, Hermann.

Sternoptyx diaphana, Hermann, Naturforscher, XVI. p. 781, p. 8, Taf. I. figs. 1 and 2; XVII. p. 249 ("Copied by Walbaum, Artedi, Ill., Vol. I. figs. 1 and 2, and by Schneider, p. 494, Pl. XXXV."). Cuvier, Règne Animal, 2d ed., Pl. XIII. fig. I. Cuvier & Valenciennes, Hist. Nat. Poiss., XXII. p. 415. Günther, Cat. Fish. Brit. Mus., V. p. 387 (no specimens).

Specimens were caught at the stations mentioned below.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
323	33° 19′	76° 12′ 30″	457	1
316	32° 7′	78° 37′ 30″	229	1

40. Argyropelecus hemigymnus, Cocco.

Argyropelecus hemigymnus, Cocco, Giorn. Sc. Sic. 1829, fasc. 77, p. 146. Bonaparte, Faun. Ital. Pesc. Cuv. & Val., Hist. Nat. Poiss., XXII. p. 398. Günther, Cat. Fish. Brit. Mus., V. p. 385.

Sternoptyx hemigymnus, Valenciennes, in Cuvier, Règne Animal, Ill. Poiss., Pl. 103, fig. 3.

Sternoptyx mediterranea, Cocco, Giorni il Faro, 1838, IV. p. 7, fig. 2. Bonaparte, Faun. Ital. Pesc., Fig.

This species was obtained at Station 315, at a depth of 225 fathoms. It was also obtained by the steamer "Fish Hawk," August 18, 1882, at Station 1112 (Lat. 39° 56′ N., Long. 70° 35′ W., 245 fathoms), and was seen by Dr. Bean on the same vessel in 1880.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
315	32° 18′ 40″	78° 43′	225	2

CYCLOTHONE, new genus.

Numerous small specimens, in very bad condition, were received, belonging to an undescribed genus of the family *Sternoptychidæ*, or of some closely related family not yet defined.

Diagnosis. — Body long, somewhat compressed, apparently naked, covered with dark pigment-cells, there being no scales. A series of luminous spots along the lower sides of the body. Head conical, cleft of mouth very wide, oblique, the lower jaw strongly projecting. The maxilla is long and slender, anteriorly curved strongly upward, its outline sickle-shaped, closely connected with the short intermaxillary. Maxillary and intermaxillary with a single series of rather large acicular teeth, about every fourth one in the maxilla longer than the average. Lower jaw with teeth apparently uniform in size, raking forward, and with a few canines in front. A small patch of minute teeth upon the head of the vomer. Palate smooth. Eye moderate, inconspicuous, apparently covered with opaque membrane, causing a dull appearance. Gill opening very wide, the branchiostegal membrane free from the isthmus. Gill rakers long and slender, moderately numerous, more than twice as numerous below as above the angle.

Pseudobranchiæ absent (branchiostegals not clearly made out, apparently seven, eight, or nine). No air-bladder. All the fins well developed : the anal large : dorsal and anal fins entirely on the posterior half of the body : no adipose dorsal : caudal forked.

41. **Cyclothone lusca**, new species.

Body elongate, its greatest height contained 7⅔ times in its length to base of middle caudal rays, its width being less than two thirds of its height. Its height at the ventrals is contained 8⅓ times in standard length : the least height of tail is half that of the body at the ventrals.

Head length contained 4⅔ times in body length, its width about one third of its length. The intermaxillary is very short, extending to vertical from posterior limb of anterior nostril. The maxillary is very strongly curved downward, and has a short knob at its anterior extremity, not visible without dissection. The maxillary extends backward to a distance from the tip of the snout equal to the length of the head without the snout. The peculiar arrangement of the teeth is described above in the generic diagnosis. Most of those in the maxillary are inclined strongly forward.

The long lower jaw, with the exception of the projecting tip, is included within the upper jaw : its length is equal to the distance from the anterior nostril to the end of the head.

Eye circular, close to the profile, the interorbital area being very narrow. Its length is equal to that of the snout, and contained seven times in the length of the head.

Dorsal fin inserted at a distance from the tip of the snout equal to three times the length of the lower jaw, its base being as long as the head ; the first ray is minute, and about two thirds as long as the eye ; the second ray is about two thirds the length of the base of the fin, and the subsequent rays rapidly and uniformly decrease in length to the last, which is about twice as long as the first. All the rays except the first are bifid.

The anal fin is inserted under the second ray of the dorsal : its base is half as long again as that of the dorsal, and nearly one third as long as the body of the fish : its outline resembles that of the dorsal, though slightly emarginate, its longest ray a little longer than the longest of the dorsal, and half as long as the base of the fin. All the rays except the first are bifid.

Caudal forked, its middle rays less than half as long as the outer rays, equal in length to least height of caudal peduncle.

Pectoral inserted under the tip of the opercular flap, its length equal to the greatest height of the body.

Ventral inserted at a distance from the snout equal to twice the length of the head, its length slightly exceeding that of the pectoral, and contained seven times in the standard body length.

Radial formula : B. VII to IX ; D. I, 11 ; A. I, 16 ; C. 17 ; P. 10 ; V. 5.

Color blackish brown, the luminous pores inconspicuous.

Specimens were obtained at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
330	31° 41′	74° 35′	1047	5
323	33° 19′	76° 12′ 30″	457	37
328	34° 28′ 25″	75° 22′ 50″	1632	13
324	33° 27′ 20″	75° 53′ 30″	1386	20

SCOPELIDÆ.

42. Scopelus Mülleri (Gmel.), Collett.

Salmo Mülleri, Gmelin's Linnæus, Systema Naturæ, I., 1788, p. 1378.

Scopelus glacialis, Reinhardt, Oversigt Kgl. D. Vid. Selsk. Nat. Math. Aph. VI. p. cx., Copenhagen, 1837.

Scopelus Mülleri, Collett, Norges Fiske Tillaegsh. til. Forh. Vid. Selsk., Christiania, 1874, p. 152. Norske Nordhavs-Expedition, 1876–1878, Fiske, 1880, p. 158.

This species, known hitherto only from the coast of Greenland and the northern shores of Norway, has been frequently taken during the past two years, by the U. S. Fish Commission, off the southern shores of New England, and was also obtained by the "Blake" at the stations mentioned below.

The following specimens, all in bad condition, were obtained.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens
303	41° 34′ 30″	65° 54′ 30″	306	1
334	38° 20′ 30″	73° 26′ 40″	395	3
309	40° 11′ 40″	68° 22′	304	1
329	34° 39′ 40″	75° 14′ 40″	603	3

MICROSTOMIDÆ.

43. Hyphalonedrus chalybeius, GOODE.

Hyphalonedrus chalybeius, GOODE, Proc. U. S. Nat. Mus., III. pp. 484, 485, Feb. 16, 1881.

This species was found at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
321	32° 43′ 25″	77° 20′ 30″	233	1
316	32° 7′	78° 37′ 30″	229	1
327	34° 0′ 30″	76° 10′ 30″	178	5 bad

SACCOPHARYNGIDÆ.

44. Saccopharynx flagellum, MITCHILL.

Saccopharynx flagellum, MITCHILL, Ann. Lyc. New York, I., 1824, p. 82.

A single badly mutilated example was secured.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
331	35° 44′ 40″	74° 40′ 20″	898	1

SYNAPHOBRANCHIDÆ.

45. Synaphobranchus pinnatus (GRONOW), GTHR.

Muræna pinnata, GRONOW, Syst. ed. Gray, p. 19 (*fide* Günther).
Synaphobranchus pinnatus, GÜNTHER, Cat. Fish. Brit. Mus., VIII. p. 23.

Numerous specimens were obtained, as will be seen by referring to the following list.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	38° 18′ 40″	73° 18′ 10″	304	35
Unknown.				4
303	41° 34′ 30″	65° 54′ 30″	306	12
312	39° 50′ 45″	70° 11′	466	8
325	33° 35′ 20″	76°	647	12
337	38° 20′ 8″	73° 23′ 20″	740	2
326	33° 42′ 15″	76° 0′ 50″	464	6
Unknown.				1
329	34° 39′ 40″	75° 14′ 40″	603	4

MURÆNESOCIDÆ.

46. **Nettastoma procerum,** new species.

Two specimens of a species of *Nettastoma* were obtained at Station 325, Lat. 33° 35′ 20″, Long. 76°, at a depth of 647 fathoms. Another (mutilated), something over 190 mm. long, was taken at Station 327. The species is in many respects closely allied to the *Nettastoma melanurum* of the Mediterranean, but appears to differ from it in the greater length of the tail, the much smaller teeth, and in the presence of a filamentous nasal tip.

Description. — Body anguilliform, very elongate, compressed, — posteriorly greatly so, — and tapering to a very slender attenuate point. Its greatest height is contained nearly four times in the distance from the gill opening to the tip of the lower jaw, and equals half the length of the snout. Head slender, conical : jaws somewhat depressed : the upper jaw heavier and thicker, and projecting beyond the lower a distance equal to the diameter of the eye. Length of snout equals the distance from the posterior margin of the orbit to the gill opening : the cleft ot the mouth extends far behind the eye to a distance equal to the diameter of the eye. On each side of the upper jaw, and in advance of the eye, are twelve pores ; behind each eye are three pores, while on the median line, on the top of the upper jaw, are several pores posteriorly arranged in pairs, of which there are four, the ultimate pair being between the posterior nostrils. There is also a pair of pores upon the nape, connecting the postorbital rows, and seventeen on each side of the mandible. The mandibulary series is continued by another series extending over the cheeks and nape. The snout is provided with a slender, filamentous tip, whose length is equal to twice the diameter of the eye. The tongue is apparently absent in the specimens examined by us. The teeth are arranged as in *N. melanurum*, but exceedingly small, and much less conspicuous than in the figures of Kaup and Risso.

Dorsal fin commences above the gill opening.

The anal fin is inserted under the 73d dorsal ray at a distance from the snout equal to 3⅔ times the length of the head. The tail is twice as long as the body with the head included. The total length of the specimen is 727 millimeters, including the nasal tip, which measures 7 mm.

Lateral line highly specialized, with numerous pores, corresponding in general character to those upon the head, and arranged in a deep furrow, their distances apart being about the same as in the case of those upon the head. Height of dorsal and anal fins about equal to half the height of body.

Color apparently brownish ; peritoneum black.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
325	33° 35′ 20″	76°	647	2
327	34° 0′ 30″	76° 10′ 30″	178	1

NEMICHTHYIDÆ.

47. **Nemichthys scolopaceus**, Richardson.

Nemichythys scolopaceus, Richardson, Voyage Samarang, Fishes, p. 25, Pl. X. figs. 1–3 (*fide* Günther, Cat. Fish. Brit. Mus., VIII. p. 21).

Five individuals in all were taken at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
303	41° 34′ 30″	65° 54′ 30″	306	1
309	40° 11′ 40″	68° 22′	304	1
306	41° 32′ 50″	65° 55′	524	1
330	31° 41′	74° 35′	1047	1
338	38° 18′ 40″	73° 18′ 10″	922	1

LEPTOCEPHALIDÆ.

48. **Leptocephalus** sp. (Perhaps larva of *Synaphobranchus*.)

A single individual, measuring 175 millimeters in length, was secured at the station following.

Station.	N. Lat.	W. Long.	Fathoms.	Specimen.
315	32° 18′ 20″	78° 43′	225	1

RAIIDÆ.

49. **Raia plutonia**, Garman.

Raia plutonia, Garman, Bull. Mus. Comp. Zoöl. Cambridge, Vol. VIII. No. 11, p. 236, March, 1881.

Not in the collection studied by us. The species was taken at Stations 316, 317, and 321.

50. **Raia ornata**, Garman.

Raia ornata, Garman, Bull. Mus. Comp. Zoöl. Cambridge, Vol. VIII. No. 11, pp. 235, 236, March, 1881.

Not seen by us. Said to be a variety of *R. Ackleyi*, by Mr. Garman. Three specimens were taken at Station 314.

SCYLLIIDÆ.

51. Scyllium retiferum, Garman.

Scyllium retiferum, Garman, *op. cit.*, p. 233.

Not studied by us. One specimen was in the "Blake" collection from Station 335. The U. S. Fish Commission has since obtained several examples.

MYXINIDÆ.

52. Myxine glutinosa, Linn.

Specimens were taken at the following stations.

Station.	N. Lat.	W. Long.	Fathoms.	Specimens.
309	40° 11′ 40″	68° 22′	304	1
306	41° 32′ 50″	65° 55′	524	1
327	34° 0′ 30″	76° 10′ 30″	178	1

U. S. National Museum, Washington, D. C.,
February 22, 1883.

No. 6. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *in the Caribbean Sea in* 1878–79, *and along the Atlantic Coast of the United States during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.*

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XX.

Report on the Ophiuroidea. By THEODORE LYMAN.

THE West Indies are the hotbed of Echinodermata. Out of less than six hundred living species of Ophiuroidea now known, about one hundred and fifty-five, or more than a quarter, are from that region; and for the round Echinoderms the proportion is even larger. Beginning at low-water mark, this fauna descends to 1,568 fathoms; and, having its centre in the Caribbean Sea and the Gulf of Mexico, it sends branches northward at least as far as South Carolina, and southward to Brazil. In the present state of knowledge, it seems a well-marked fauna, containing a great number of distinctive forms, although there occasionally occur species from other marine regions, such as *Ophioscolex glacialis* and *Astronyx Loveni.* This appearance of limitation may come in part from the special investigations in this area; for it is to be borne in mind that the U. S. ships "Corwin," "Bibb," "Hassler," and "Blake" have dredged in about 570 stations, chiefly along the line of the Antilles, and from the Dry Tortugas to Cape Florida. In addition to these, some hauls were made by Dr. William Stimpson, and by the naturalists of the "Challenger."

Nearly all known genera of Ophiuroidea are there found, the most notable exceptions being Ophioplocus, Ophioplinthus, Ophiopholis, Ophiarachna, Ophiarthrum, Ophiomastix, and Trichaster.

Among Ophiurans, as in other animals, we find that certain genera are very rich in species; such are Ophioglypha, Amphiura, Ophiacantha, and Ophiothrix, which contain two thirds as many species as do all the remaining sixty-eight genera in the family. A peculiar structure does not necessarily entail abundance of species, for the Astrophyton-like Ophiurans (e. g. Ophiomyxa) have few species.

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* In this paper are included six new species from the dredgings of the "Porcupine" and the "Challenger," which are published by permission of the Lords Commissioners of the Treasury.

There are included in this paper three unpublished species from the dredgings of H. B. M. ship "Porcupine," — *Ophiochiton tenuispinus*, *Ophiomyxa serpentaria*, and *Ophiobyrsa hystricis;* and from the "Challenger" expedition there are one genus and three species whose originals were found among the collections of the late Sir Wyville Thomson. They are *Ophiocopa spatula*, *Ophiacantha scolopendrica*, and *Ophiomastus texturatus*. All the rest are from the "Blake" dredgings.

The following list of species will show all new information as to the depths at which they occur, and will give some notion of their frequency, by the number of stations at which they are found.

Ophiopæpale Goesiana. Up to 38 fathoms.

Ophiozona nivea. From twenty-six stations, and in large numbers. Up to 50 fathoms.

Ophiozona tessellata. From seventeen stations. 60–300 fathoms.

Ophiozona impressa. Down to 300 fathoms.

Ophiozona antillarum. Ten stations. 94–508 fathoms.

Ophioglypha Sarsii. Found as far south as 35° 45′ 30″ N., and down to 306 fathoms.

Ophioglypha lepida. Ten stations.

Ophioglypha falcifera. Twelve stations. 200–508 fathoms.

Ophioglypha variabilis. Twenty-six stations. Up to 175 fathoms.

Ophiomusium eburneum. Twenty-two stations. 95–390 fathoms.

Ophiomusium Lymani was dredged at only nine stations, but in such quantities that Mr. Agassiz was forced to throw away a large part. These hauls illustrate the abundance of animal life at great depths; for the shallowest station was 810 fathoms.

Ophiomusium validum. The great number of stations (thirty-two) at which it was dredged show its frequent occurrence, as well as its variation in depth, now known to run from 60 to 1568 fathoms.

Ophiomusium testudo. Sixteen stations. 69–508 fathoms.

Ophiomusium planum. Up to 300 fathoms.

Ophiomusium acuferum. This humble species, described by me in 1875 from the "Hassler" dredgings, proves to be the most widely spread in that fauna. It also inhabits very diverse depths, and must accommodate itself to temperatures varying from 78° to 39° Fah. Strangely enough, it has not yet been found outside the West Indian limits. Thirty-five stations. 27–1030 fathoms.

Ophiomusium serratum. Thirteen stations. 124–1097 fathoms.

Ophiomastus secundus. Thirteen stations. 60–1131 fathoms.

Ophiopyren longispinus. Eighteen stations. 60–625 fathoms.

Ophioconis miliaria. Up to 163 fathoms.

Ophiochœta mixta. Down to 572 fathoms.

Ophiactis Mülleri var. **quinqueradia.** 27–338 fathoms.

Amphiura duplicata, like *Ophioglypha variabilis* and *Ophiomusium acuferum,* is plentiful, and is found over a great range of depth. Thirty-four stations.

Amphiura Otteri. There is some question about the distinction of those species that stand near the old *A. Chiajei.* I believe, however, that Ljungman's species was found by the "Blake" from 41° 32′ 50″ N. to the island of Grenada on the south, and from 175 to 576 fathoms.

Amphiura tumida. Up to 94 fathoms.

Amphiura lunaris. Up to 424 fathoms.

Amphiura cuneata. 159–370 fathoms.

Amphiura Stimpsoni. Down to 69 fathoms.

Ophionereis reticulata. Down to 94 fathoms.

Ophioplax Ljungmani. Eleven stations. Down to 175 fathoms.

Ophiostigma isacanthum. Down to 122 fathoms.

Ophiacantha bidentata. From as far south as 33° 27′ 20″ N.

Ophiacantha hirsuta. Twelve stations. 82–955 fathoms.

Ophiacantha sertata. Ten stations. 150–411 fathoms.

Ophiacantha vepratica. Seven stations. Up to 291 fathoms.

Ophiacantha scutata. Nine stations. 124–338 fathoms.

Ophiacantha echinulata. Up to 303 fathoms.

Ophiacantha pentacrinus. Twenty-four stations. Down to 625 fathoms.

Ophiacantha stellata. Twelve stations. 56–262 fathoms.

Ophiacantha aspera. Twelve stations. 73–262 fathoms.

Ophiomitra valida. Twenty-four stations. Down to 1105 fathoms. Another abundant species, of great range in depth.

Ophiocamax hystrix. Fifteen stations. 114–300 fathoms.

Ophiothamnus vicarius. Six stations. Down to 611 fathoms.

Ophiothrix Suensonii. Twenty-one stations. Down to 262 fathoms.

Ophiothrix angulata. Fourteen stations. Down to 262 fathoms.

Ophioscolex tropicus. 103–502 fathoms.

Ophiomyces mirabilis. Down to 422 fathoms.

Ophiomyces frutectosus. Down to 288 fathoms.

Ophiochondrus convolutus. Eleven stations. Up to 88 fathoms.

Sigsbeia murrhina. Twenty-one stations.

Gorgonocephalus mucronatus. Down to 288 fathoms.

Astrogomphus vallatus. 114–337 fathoms.

Astroporpa annulata. Sixteen stations. Down to 163 fathoms.

Astrochele Lymani. Down to 980 fathoms.

Astroschema arenosum. Eight stations. Up to 120 fathoms.

Astroschema læve. Sixteen stations. 56–262 fathoms.
Astroschema oligactes. Seventeen stations.
Astroschema tenue. Four stations. 88–124 fathoms.
Ophiocreas lumbricus. Seven stations. Down to 580 fathoms.
Ophiocreas œdipus. Down to 580 fathoms.
Astronyx Loveni (young). Down to 980 fathoms.

Ophiura Elaps ? Lym.

These fine specimens, of which the largest had a disk of 28 mm. and arms of about 200 mm., only differed from Lütken's description (Addit. ad Hist. Oph., Pt. II. p. 93) in having six or seven, instead of seven or eight arm-spines, of which the upper ones were longest.

Station (Bartlett) 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms. Station 157, Montserrat, 120 fathoms. Station 241, Grenadines, 163 fathoms.

Ophiura brevispina Lym.

Station 142, Flannegan Passage, 27 fathoms. Station 152, St. Kitts, 122 fathoms. Station 285, Barbados, 13–40 fathoms.

Ophiura cinerea Lym.

Station 132, Santa Cruz, 115 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms.

Pectinura tessellata sp. nov.

Plate III. Figs. 1-3.

Special Marks. — One tentacle-scale : four or five short arm-spines. Under arm-plates narrow and rounded. Granulation of disk continuous above, but with naked patches below.

Description of an Individual (Station 130). — Diameter of disk 17.5 mm. Length of arm about 95 mm. Width of arm close to disk 4 mm. Sixteen stout mouth-papillæ to each angle, whereof the one next the outermost is much the widest and stoutest, while those within grow gradually narrower and more peg-like. Four flat, stout, short teeth, the lowest one of which is sometimes cleft. Mouth-shields wide heart-shape with a rounded point within. The supplementary shield lies just outside and forms one of a number of thick naked plates which partly cover the lower interbrachial space. Side mouth-shields three-cornered and very small, lying next the outer corners of the mouth-shields. Under arm-plates occupying less than half the width of the arm ; as long as broad ; bounded without by a curve, within by a truncated angle, and on the sides by a re-entering curve. Side arm-plates occupying about two thirds of the height of the arm, and having a cleanly curved outer side. Upper arm-plates arched (but not so strongly as in *O. heros*), wider without than within, and having straight outer and inner sides. Disk angular, closely and evenly covered above, except the radial shields, with a fine granulation having about six grains in the length of 1 mm. Interbrachial spaces below have a reticulated look, from the numerous bare plates among the granulation. Radial shields wide oval; length to breadth, 2.3 : 1.8. Genital opening long, extending from mouth-shield nearly to edge of disk. Four or five small, peg-like, even, spaced arm-spines, a little more than half the length of a joint. One stout, round tentacle-scale.

Station 130, near Frederickstadt, 451 fathoms, 1 specimen.

This species is well distinguished from *P. heros* and *P. lacertosa* by a flatter arm, four or five peg-like spaced arm-spines, and naked plates in the lower interbrachial space.

Pectinura lacertosa sp. nov.

Plate III. Figs. 4-6.

Special Marks. — Three arm-spines about as long as a joint and standing low down on side of arm. Indentations, but no pores, between the first four or five lower arm-plates. Arms short; only three and a half or four times the diameter of the disk. One large, round tentacle-scale.

Description of an Individual (Station 258). — Diameter of disk 35 mm. Length of arm about 135 mm. Width of arm close to disk, without spines, 6 mm. About twenty mouth-papillæ to each angle, whereof the two or three outer ones are wide and squarish, while those within are sharp and peg-like. The two lowest teeth are replaced by similar papillæ. Mouth-shields short heart-shape with a rounded angle within; length to breadth, 4 : 5. There are sometimes one or more large scales, or supplementary pieces, just outside. Side mouth-shields very small and nearly obliterated. Under arm-plates about as wide as long, bounded without by a curve, within by a truncated angle, and on the sides by a re-entering curve. Side arm-plates low, occupying only about one half the height of the arm, and meeting neither above nor below. Upper arm-plates highly arched, closely overlapping, with outer and inner edges nearly straight; each is usually broken in two pieces. Disk angular, closely and evenly covered with very fine granules, 7 or 8 in the length of 1 mm., except the radial shields and sometimes a small plate on the margin. Radial shields egg-shaped, somewhat longer than broad with outer and inner ends much rounded; length to breadth, 4 : 2.5. Lower interbrachial space covered by a similar granulation, extending even to the mouth-angle. There are none on the mouth-shields, outside which are one or more thick, partially naked scales, representing the supplementary shield. Genital opening long, extending from mouth-shield nearly to margin of disk. Three, sometimes four, stout, rounded, tapering arm-spines, not quite as long as a joint. One round, thick tentacle-scale. Color in alcohol, nearly white.

Station 258, near Grenada, 159 fathoms, 1 specimen.

This species is very near *P. heros*, dredged in 900 fathoms by the "Challenger," near New Guinea, but differs in its longer and differently placed arm-spines, and in the indentations between the basal under arm-plates.

Pectinura angulata sp. nov.

Plate III. Figs. 7-9.

Special Marks. — Disk with thin scales covered by a fine granulation. Nine arm-spines, of which the lowest is longest and broad and flat. Pores only between the first three under arm-plates.

Description of an Individual (Station 134). — Diameter of disk 27 mm. Width of arm close to disk 5.5 mm. About twenty mouth-papillæ to each angle, of which the two or three outer ones are much the widest and are squarish, while those within are spiniform. The lowest of the five broad, flat teeth is split in two, and there are sometimes one or two additional papillæ at the apex of the mouth-angle. Under arm-plates within the disk wider than long, bounded without by a curve, within by a wide much-truncated angle, and on the sides by re-entering curves. Further out they are as long as broad and nearly octagonal. They are stout but not swollen, and there are pairs of pores between the first three. Side arm-plates with a gently curved outer edge, and occupying nearly the whole height of the arm. Upper arm-plates smooth, nearly flat, regular, with straight outer and inner sides, and the outer corners rounded. They occupy nearly the whole upper surface. Length to breadth, 1.5 : 4. Mouth-shields short heart-shape, with a rounded angle within. Length to breadth, 4 : 5.5. Supplementary shields small, and swollen ; length to breadth, 1 : 1.3. Side mouth-shields reduced to a little plate, at the outer corner of the mouth-shield. Disk angular, and covered by a close, fine granulation, which is easily rubbed off, as is shown in the figure. There are about seven grains in the length of 1 mm. Radial shields naked, of a narrow oval shape and pointed within ; length to breadth, 4 : 2. The scale-coat of the disk is of thin delicate scales about 1 mm. in length. Arm-spines nine, the eight uppermost slender, pointed, and flattened, and about three fourths the length of a joint. The lowest one is much wider, blunt, and longer than a joint. Two tentacle-scales of a short spatula-shape : the upper one covering the base of the lowest arm-spine. On the first tentacle-pore there are usually two supplementary scales placed just outside the pore. Color in alcohol, nearly white.

Station 134, near Santa Cruz, 248 fathoms, 1 specimen. Station 232, St. Vincent, 88 fathoms.

This species is nearest *P. rigida*, from which it is distinguished by a shorter under arm-spine, larger radial shields, coarser disk-scales, and pores between the under arm-plates extending only to three joints.

In other specimens the granulation was uninterrupted over the disk, except small spots at the radial shields. The supplementary mouth-shield is often very small, and ill marked.

Ophiopæpale Goesiana Ljn.

Station 101, Morro Light, 175–250 fathoms. Station 132, Santa Cruz, 115 fathoms (young). Station 127, Santa Cruz, 38 fathoms. Station 155, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 253, Grenada, 92 fathoms. Station 269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 293, Barbados, 82 fathoms. Station 297, Barbados, 123 fathoms.

Ophiozona marmorea sp. nov.

Plate III. Figs. 10-12.

Special Marks. — Arms very stout and short (two and a half times diameter of disk), with strongly projecting side arm-plates and small sunken upper arm-plates. Side mouth-shields much swollen. Lower interbrachial spaces with scattered grains.

Description of an Individual (Station 164). — Diameter of disk 8 mm. Length of arm 19 mm. Width of arm next disk 2.3 mm. Five short, blunt, crowded angular papillæ to each mouth-angle, and, at the apex, the lowest of the short teeth ; the outer papillæ are largest. Mouth-shields small, much larger than broad, five-sided with a curve without and an angle within ; length to breadth, 1.2 : .8. Side mouth-shields larger than mouth-shields proper ; much swollen, rudely triangular, and meeting fully within. First under arm-plate small and pentagonal, with a long angle inward ; those beyond are much larger, but still cover only about a third of the arm's width ; they are much wider without than within, with a sharp peak on the outer corners, and re-entering curves on the lateral sides ; length to breadth, 1.2 : .8. Side arm-plates large and swollen, but meeting neither above nor below. Upper arm-plates small and sunken, fan-shaped, with a truncated angle inward ; they cover not more than a third of the upper surface. Disk covered by large, thick, swollen rounded plates, with a central rosette of primaries and a radiating row of three in each interbrachial space. Radial shields longer than broad, rounded and swollen, separated by a wedge of two or three scales ; length to breadth, 2.3 : 2 ; between their outer ends and the arm is a row of narrow plates. Interbrachial spaces below covered on either side by stout genital scales, and in the middle by a single row of two or three swollen plates ; they bear a scattered granulation. Genital openings long, extending from sides of radial shields to margin of disk. Four short, stout, tapering, blunt, equal arm-spines, about two thirds as long as a joint. Two large oval tentacle-scales to each pore. Color in alcohol, white.

Station 101, 175–250 fathoms, 1 specimen. Station 134, 248 fathoms, 3 specimens. Station 158, 148 fathoms, 1 specimen. Station 164, Guadeloupe, 150 fathoms, 11 specimens. Station 220, 160 fathoms, 1 specimen. Station 224, 114 fathoms, 1 specimen.

O. marmorea is nearest *O. nivea*, from which it differs in its swollen disk-plates, side arm-plate and side mouth-shields, its smaller upper arm-plates, and shorter arms, and in granulation on the lower interbrachial space.

Ophiozona clypeata sp. nov.

Plate III. Figs. 13-15.

Special Marks. — Eleven close-set, lumpy mouth-papillæ to each angle. Side mouth-shields large and wide. Three moderately stout arm-spines, about as long as a joint.

Description of an Individual (Station 219). — Diameter of disk 10 mm. Length of arm 65 mm. Width of arm near disk 2 mm. Eleven short, lumpy, crowded mouth-papillæ to each angle, whereof the one next the outermost is widest. Mouth-shields blunt spear-head shape, with the point inward; length to breadth, 1.5 : 1. Side mouth-shields rather wide and fully meeting within. Under arm-plates thick, but not ridged, much wider without than within where they are bounded by a wide truncated angle, while the outer is a broken curve and the lateral sides are re-entering curves. Side arm-plates short and stout, with a low spine-ridge. Upper arm-plates twice as broad as long, and much wider without than within. Disk round and flat, covered with distinct rounded slightly swollen overlapping scales, among which the primaries are conspicuous by their greater size. Radial shields short, oval; length to breadth, 1.2 : 8. In the interbrachial spaces below, the scales are of uniform size, about three in the length of 1 mm. Genital openings long, extending from outer corners of the mouth-shield quite to margin of disk. Three moderately stout, cylindrical, tapering, blunt arm-spines; the two upper ones as long as a joint, the lowest a little longer. Two rudely semicircular tentacle-scales on the side arm-plate, whereof the one next the under arm-plate is smaller. Color in alcohol, nearly white.

Station 219, off Saint Lucia, 151 fathoms, 1 specimen. Station 232, St. Vincent, 88 fathoms.

By its smaller disk-scales and longer and more pliable arms this species connects the large-scaled and stiff-armed Ophiozonæ with the type *O. impressa*. It shows, too, the affinity of the genus to Ophiochiton through *O. lentus*.

Ophiozona nivea Lym.

Station 129, Santa Cruz, 314 fathoms. Station 145, St. Kitts, 270 fathoms. Station 146, St. Kitts, 245 fathoms. Station 147. St. Kitts, 250 fathoms. Station 148, St. Kitts, 208 fathoms. Station 154, Montserrat, 298 fathoms. Station 155, Montserrat, 88 fathoms. Station 172, Guadeloupe, 62-180 fathoms. Station 183, Dominica, 252 fathoms. Station 208, Martinique, 213 fathoms. Station 209, Martinique, 189 fathoms. Station 210, Martinique, 191 fathoms. Station 215, St. Lucia, 226 fathoms. Station 216, St. Lucia, 154 fathoms. Station 218, St. Lucia, 164 fathoms. Station 219, St Lucia, 151 fathoms. Station 224, St. Vincent, 114 fathoms. Station 238, Grenadines, 127 fathoms. Station 241, Grenadines, 163 fathoms. Station 258, Grenada, 159 fathoms. Station 273, Barbados, 103 fathoms. Station 274, Barbados, 209 fathoms. Station 280, Barbados, 221 fathoms. Station 291, Barbados, 200 fathoms. Station 292, Barbados, 56 fathoms. Station 294, Barbados, 137 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms, sp. ?

Ophiozona tessellata Lym.

Station 134, Santa Cruz, 248 fathoms. Station 149, St. Kitts, 60–150 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 158, Montserrat, 148 fathoms. Station 166, Guadeloupe, 150 fathoms. Station 206, Martinique, 170 fathoms. Station 208, Martinique, 213 fathoms. Station 220, St. Lucia, 116 fathoms. Station 231, St. Vincent, 95 fathoms. Station 238, Grenadines, 127 fathoms. Station 273, Barbados, 103 fathoms. Station 282, Barbados, 154 fathoms. Station 290, Barbados, 73 fathoms. Station 297, Barbados, 123 fathoms. Station 299, Barbados, 140 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiozona impressa Lym.

Station 132, Santa Cruz, 115 fathoms. Station 272, Barbados, 76 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms. Station 298, Barbados, 120 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiozona antillarum Lym.

Station 136, Santa Cruz, 508 fathoms. Station 204, Martinique, 476 fathoms. Station 205, Martinique, 334 fathoms. Station 208, Martinique, 213 fathoms. Station 211, Martinique, 357 fathoms. Station 273, Barbados, 103 fathoms. Station 276, Barbados, 94 fathoms. Station 288, Barbados, 399 fathoms. Station 291, Barbados, 200 fathoms. Bartlett, Station 24, 5 m. E. of Cape Cruz, S. side of Cuba, 206 fathoms.

Ophiothyreus Goesii Ljn.

Station 101, Morro Light, 175–250 fathoms. Station 155, Montserrat, 88 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiernus adspersus sp. nov.

Plate III. Figs. 19-21.

Special Marks. — Two or three small, unequal arm-spines. Arms flat and very wide, their width being about one third the diameter of the disk. Mouth-frames narrow and prolonged.

Description of an Individual (Station 150). — Diameter of disk 13 mm. Width of arm close to disk 4 mm. Four short, rounded, bead-like, close-set papillæ on either side of the narrow, prolonged mouth-angle, and three longer ones under the teeth, which are five in number and are short and stout. There are also three or four bead-like papillæ on the side mouth-shield, and a much wider one outside them, all of which may be considered as scales of the second pair of mouth-tentacles. Mouth-shields about as broad as long, — 1.6 : 1.6, — of an angular heart-shape, with the point inward. Side mouth-shields long triangular, embracing the sides of the mouth-shields and not quite meeting within. First under arm-plate small and swollen, of an irregular rounded shape. The plates beyond are narrow, with lateral sides re-enteringly curved opposite the tentacle-pores. They are very small, and occupy not more than a quarter of the width of the arm. Side arm-plates wide, thin, and flat ; they do not quite meet below, and are broadly separated above by the upper arm-plates, which cover all that surface of the arm ; they are thus feebly arched, much wider than long, wider without than within, and having the outer and inner margins straight. Disk flat, with re-entering curves over the arms ; covered by thin, flat, irregular, strongly overlapping, ill-defined scales, which are beset with minute granules, of which there are about eight in the length of 1 mm. where they are closest. Radial shields nearly naked, of an irregular pear-seed shape, with the point inward, widely separated by the disk-scaling, and nearly naked ; length to breadth, 4 : 2. Lower interbrachial spaces more finely and regularly scaled. Genital openings long and wide, with a broad genital scale at the outer end. Arm-spines two, rarely three ; they are slender and peg-like. The upper one is longest, and about half as long as a joint. Two, rarely three, small, flat, oval tentacle-scales standing on the side arm-plate. Color in alcohol, pale gray. The fragile arms are long and slender, being about nine times the diameter of the disk. In its natural state the disk is probably closely granulated, but the grains are easily rubbed off.

The wide arms and different mouth-angles distinguish it from *O. vallincola.*

Station 129, Frederickstadt, 314 fathoms. Station 130, Santa Cruz, 451 fathoms. Station 150, between St. Kitts and Nevis, 375 fathoms. Station 148, St. Kitts, 208 fathoms. Station 161, Guadeloupe, 583 fathoms. Station 176, Dominica, 391 fathoms. Station 185, Dominica, 333 fathoms. Station 188, Dominica, 372 fathoms. Station 190, Dominica, 542 fathoms. Station 196, Martinique, 1,030 fathoms. Station 221, St. Lucia, 423 fathoms. Station 222, St. Lucia, 422 fathoms. Station 226, St. Vincent, 424 fathoms. Station 230, St. Vincent, 464 fathoms. Station 239, Grenadines, 338 fathoms. Station 258, Grenada, 159 fathoms. Station 260, Grenada, 291 fathoms. Station 264, Grenada, 416 fathoms. Station 288, Barbados, 399 fathoms. Station 291, Barbados, 200 fathoms. Capt. Bartlett, 1880, Lat. 17° 30′ N., Long. 79° 14′ W., 555 fathoms; also, 17° 45′ N., 77° 58′ W., 322 fathoms.

Ophioglypha fasciculata sp. nov.

Plate III. Figs. 22-24.

Special Marks. — Four spaced arm-spines. Upper surface of thick disk chiefly covered by radial shields, rosette of primary plates and large plate in each interbrachial space; no large plate on margin. Basal under arm-plates broader than long. Whole surface microscopically tuberculous. Papillæ of arm-comb flattened spiniform.

Description of an Individual. — Diameter of disk 13 mm. Width of arm near disk 3 mm. Three or four rectangular, crowded papillæ on each side of a mouth-angle, and two or three conical ones at its apex. Mouth-shields very large, much longer than broad, having the outline of a wide-mouthed jug, and with the small lobe-like end inward; length to breadth, 3:2. Side mouth-shields narrow, and of nearly equal width, meeting fully within. First under arm-plate larger than any other, longer than wide, narrower within than without; the rest, within disk, are wider than long, and four-sided; those beyond become gradually hexagonal. Side arm-plates swollen, meeting neither above nor below. Basal upper arm-plates more than twice as broad as long, with well-marked angles at their lateral ends. Disk thick, covered above by a central rosette of large primary plates and a large plate in each interbrachial space; on margin of disk are a lot of small scales, and a single line between the chief plates. Lower interbrachial spaces partly covered by large mouth-shield, and partly by imbricated scales. Radial shields longer than wide, irregular and somewhat angular in outline, joined for about half their length. Genital scales narrow next radial shield, but growing wider without; they bear on their free edge a continuous but not crowded line of small, sharp papillæ, which on the upper side of arm become spiniform, and form the comb. Four spaced arm-spines about two thirds as long as a joint. Tentacle-pores large; mouth-tentacles with a straight line of five or six small, squarish, crowded scales on either side; the others, within the disk, have usually five on the side arm-plate, and two or three on the under arm-plate. Color in alcohol, pale gray.

Station 281, Barbados, 288 fathoms, 2 specimens.

O. bullata is nearest, but differs in finer disk-scales, large marginal plates, separated radial shields, differently shaped arm-comb papillæ, and only three minute arm-spines.

Ophioglypha abyssorum sp. nov.

Plate III. Figs. 25-27.

Special Marks. — Surface microscopically tuberculous. Arm-spines rudimentary, or wanting. No papillæ along genital scale on the under surface, and only two or three in each arm-comb. Side arm-plates not swollen.

Description of an Individual. — Diameter of disk 11 mm. Width of arm near disk 2 mm. Four or five rectangular, crowded papillæ on either side of a mouth-angle, and one diamond-shaped (lowest tooth) at apex. Mouth-shields wide angular heart-shape, with a peak inward; length to breadth, 2.5 : 2. Side mouth-shields rather wide, and meeting fully within. First under arm-plate larger than the rest, longer than wide, bell-shaped with a very gentle curve without, and a long curve within; the next two plates are wider than long, rounded pentagonal with an angle inward; those beyond are smaller, almost transverse diamond in form, with outer side gently curved. Side arm-plates meeting fully below; also above, beyond the first two upper arm-plates, which are rounded diamond-shape with the inner angle truncated; those beyond are as broad as long, and diamond-shaped with rounded angles. Disk smooth and not very thick, having in the centre a large, round primary plate, which is separated from the other five by a circle of smaller angular plates, similar to those which cover the rest of the disk, some of which are, however, larger. Radial shields large and a little sunken, of a short, irregular pear-seed shape, almost wholly separated by an outer and an inner wedge of disk-scales; length to breadth, 3 : 2.3. Interbrachial spaces below chiefly filled by two large central plates and the broad genital scales, which bear no papillæ on their free edge. It is only on the upper surface of the arm, just outside the radial shields, that a rudimentary comb is found, made up of two or three block-like papillæ. The joints within the disk have one or two rudimentary spines, the rest none. Mouth-tentacle pores surrounded by eight or nine small, crowded block-like scales; the next two have five such scales; those beyond, one very minute papilla, or none. Color in alcohol, pale gray.

Station 140, Virgen Gorda, 1,097 fathoms, 5 specimens.

The species differs from *O. confragosa* in its even, microscopically tuberculated surface, its side arm-plates not swollen, under arm-plates of a different shape, and arm-spines rudimentary or wanting.

Ophioglypha scutata sp. nov.

Plate IV. Figs. 28-30.

Special Marks. — Upper disk chiefly covered by large radial shields and primary plates, with two plates in each interbrachial space. Papillæ of genital scale blunt, and forming above a close row. Three little arm-spines about one third as long as a joint.

Description of an Individual (Station 231).— Diameter of disk 6 mm. Width of arm close to disk 1 mm. Three short, oblong, close-set papillæ on each side of mouth-angle, and at its apex a group of three smaller and bluntly pointed ones, whereof the centre one is largest. Mouth-shield rounded quadrangular, with an angle inward ; length to breadth, 1 : 1. Side mouth-shields rather short and narrow, running along inner angle of mouth-shield. First under arm-plate large and triangular, with a curved outer side. The next three plates wider than long, with a gently curved outer side, an obtuse angle within, and re-entering curves on the sides. The plates beyond grow suddenly smaller, and are much wider than long. Side arm-plates large and a little swollen, meeting above and below. Upper arm-plates three-sided, with an angle inward. Disk flat, and covered above in the centre by a group of six large primary plates, whereof the middle one is pentagonal, and the rest rounded. Outside these are two large elongated plates, placed end to end and occupying the interbrachial space. The remaining upper surface is covered by very large radial shields, which are as wide as long, and of irregular outline, joined for their whole length, except at the inner point, where they are separated by a small scale ; length to breadth, 1.2 : 1.3. The lower interbrachial space is almost wholly occupied by a large hexagonal plate lying outside the mouth-shield and the rather wide genital scales, which bear blunt, bead-like papillæ continued in an unbroken line over top of arm just along outer edge of part of the radial shield. Three short, equal, stout, peg-like arm-spines, about one third as long as a joint. First three tentacle-pores, with three lumpy close-set scales on each side. The fourth has two scales on either side, and those beyond have none. Color in alcohol, white.

Station 231, off St. Vincent, 95 fathoms, 1 specimen.

This specimen is probably not adult, but its characters are so marked that there seems no doubt of its novelty. In the small number and large size of its disk-plates, it resembles *O. minuta.*

Ophioglypha tenera sp. nov.

Plate IV. Figs. 31-33.

Special Marks. — Three short, blunt, spaced arm-spines, less than half as long as a joint. Disk-scales somewhat swollen and mostly large. Radial shields joined for a part of their length. Papillæ of arm-comb close-set, flat, and with rounded ends.

Description of an Individual. — Diameter of disk 5.5 mm. Width of arm 1.2 mm. Mouth-angles large and regular, bearing on each side five or six low papillæ, which are much crowded, and form a straight line ; the outermost are much longer than high, while the inner ones are almost bead-like; at the apex and on the jaw-plate are two spiniform papillæ, between which appears the lowest tooth. Mouth-shields five-sided, bounded within by a well-marked angle, and without by a curve; length to breadth 1.2 : 1. Side mouth-shields narrow and tapering within, where they join. First under arm-plate as broad as long, four-sided with much rounded corners. Those beyond have essentially a five-sided outline, but the second plate has its corners much rounded, while the others are more regular and have a well-marked peak within. Side arm-plates meeting below, but not above next the disk; slightly flaring so as to make a distinct shoulder, which carries the spines. Upper arm-plates broad wedge-shape, with an angle inward, which in the first two is truncated. Upper surface of disk with a central rosette of six slightly swollen, irregularly rounded primary plates, outside which is the great plate which separates the ends of the radial shields, and, in the interbrachial space, two other large plates, one of which is on the margin. Besides these there are numerous small intercalated scales. Interbrachial spaces below covered by half a dozen irregular angular plates ; besides which the narrow genital plates appear running along the genital openings quite to the margin of the disk. A row of fine papillæ stands on the edge of the genital scale, which grow suddenly larger, as the plate passes to the top of the arm, and form a close comb of flattened papillæ with rounded ends. Three small, equal, peg-like, spaced arm-spines, less than half as long as a joint. Mouth-tentacles with five or six minute, bead-like scales on each side ; the next have three or four ; the second and third have three on the side arm-plates, and the fourth, one. Color in alcohol, pale gray.

Station 269, off St. Vincent, 124 fathoms, 4 specimens.

This species stands nearest *O. costata*, but has longer arm-spines, disk-scales more swollen and separated, side arm-plates more flaring, and radial shields joined.

Ophioglypha aurantiaca Vll.

Vll., Amer. Journ. Sci., XXIII. p. 141, 1882.

Plate IV. Figs. 34-36.

Special Marks. — Disk covered by a smooth skin, through which the scales of the upper surface are scarcely to be made out, while those of the lower surface are more distinct. Three wide, flattened arm-spines, the upper one longer than an arm-joint, the others not so long. No comb above the base of the arm.

Description of an Individual (Station 312). — Diameter of disk 11.5 mm. Width of arm close to disk 2.5 mm. About eleven small, bead-like, slightly spaced mouth-papillæ to each angle. Four or five small spear-head-shaped teeth. Mouth-shield very wide heart-shaped, with an obtuse angle inward ; length to breadth, 2 : 1. Side mouth-shields long, with an irregular outline, and widest at their outer ends. First under arm-plate rounded hexagonal, and about as broad as long. The next two are of an irregular transverse oval shape, and those immediately beyond are much wider than long with a curve without and a peak within. Side arm-plates clinging close to the arm, and but slightly swollen, scarcely meeting below near base of arm, and separated above by four-sided upper arm-plates, which are as broad as long, and have the outer side curved, and the laterals straight. Disk round, smooth, and somewhat swollen, covered by skin, through which the scaling of the upper surface is only vaguely indicated. In the lower interbrachial spaces the scales are plainly indicated ; they are thin, rounded, pretty even, and about three in the length of 2 mm. When the specimen is dry the scales are of course more distinct. Radial shields small, irregularly three-sided; widely separated, except at their outer ends, which overhang the arm. Along the edge of the genital opening, whose scale is completely obscured, runs a line of minute, sharp papillæ, which stops at the disk margin and does not pass upwards to form an arm-comb. Three wide, flattened, slightly rough arm-spines, whereof the uppermost is longer than a joint, the middle one as long as a joint, and the lowest one shortest and somewhat tapering. Each mouth-tentacle is surrounded by about ten small, bead-like, close-set scales ; the next pore has six, and those beyond two, which stand on the side arm-plate. Color in alcohol, pale gray ; of living animal, bright orange (Verrill).

Station 312, 39° 50′ 45″ N., 70° 11′ W., 466 fathoms. Station 306, 41° 32′ 50″ N., 65° 55′ W., 524 fathoms, 2 specimens.

A young one, with a disk of 4 mm., had more slender arm-spines, the back scaling less indistinct, and the under arm-plates narrower and more widely separated.

This species is nearest *O. flagellata*, but differs in having shorter arm-spines, and in wanting an arm-comb.

Ophioglypha affinis ?

Station 344, 40° 1′ N., 70° 58′ W.

Ophioglypha confragosa Lym.

Station 312, 39° 50′ 45″ N., 70° 11′ W. Young.

Ophioglypha Sarsii Lym.

Station 346, 40° 25′ 35″ N., 71° 10′ 30″ W., 44 fathoms. Station 332, 35° 45′ 30″ N., 74° 48′ W., 263 fathoms. Station 344, 40° 1′ N., 70° 58′ W., 129 fathoms. Station 303, 41° 34′ 30″ N., 65° 54′ 30″ W., 306 fathoms.

Ophioglypha lepida Lym.

Station 228, St. Vincent, 785 fathoms. Station 307, 41° 29′ 45″ N., 65° 47′ 10″ W., 980 fathoms. Bartlett, Station 14, Grand Cayman Island, 608 fathoms. Station 308, 41° 24′ 45″ N., 65° 35′ 30″ W., 1,242 fathoms. Bartlett, Station 18, 18° 20′ 30″ N., 87° 16′ 40″ W., 600 fathoms. Station 330, 31° 41′ N., 74° 35′ W., 1,047 fathoms. Station 339, 38° 16′ 45″ N., 73° 10′ 30″ W., 1,186 fathoms. Station 340, 39° 25′ 30″ N., 70° 58′ 40″ W., 1,394 fathoms. Station 341, 39° 38′ 20″ N., 70° 56′ W., 1,241 fathoms.

Ophioglypha Stuwitzii var.?

Station 321, 32° 43′ 25″ N., 77° 20′ 30″ W., 233 fathoms.

Ophioglypha acervata Lym.

Station 132, Santa Cruz, 115 fathoms. Station 143, Saba Bank, 150 fathoms. Station 149, St. Kitts, 60–150 fathoms. Station 177, Dominica, 118 fathoms. Station 253, Grenada, 92 fathoms. Station 259, Grenada, 159 fathoms. Station 262, Grenada, 92 fathoms. Station 316, 32° 7′ N., 78° 37′ 30″ W., 229 fathoms. Station 315, 32° 18′ 20″ N., 78° 43′ W., 225 fathoms.

NOTES ON OPHIOGLYPHA.

Ophioglypha falcifera Lym.

Plate IV. Figs. 37-39.

In the original description (Bull. Mus. Comp. Zoöl., I., No. 10, p. 320) I said : "We may look for an adult of this curious species about the size of *O. Sarsii*, or rather smaller, and having a large number of small plates on the disk."

A considerable number of specimens were brought in by this expedition, of which the largest had a disk of 13 mm., and the arm 52 mm. long. The disk was covered by coarse, well-defined scales, the interbrachial margin being almost wholly occupied by a single plate. The hook-like form of the middle arm-spine could be traced to within half a dozen joints of the disk.

Station 130, Frederickstadt, 451 fathoms. Station 136, Frederickstadt, 508 fathoms. Station 185, Dominica, 333 fathoms. Station 188, Dominica, 372 fathoms. Station 195, Martinique, 502½ fathoms. Station 204, Martinique, 476 fathoms. Station 221, St. Lucia, 423 fathoms. Station 222, St. Lucia, 422 fathoms. Station 226, St. Vincent, 424 fathoms. Station 230, St. Vincent, 464 fathoms. Station 265, Grenada, 576 fathoms. Station 291, Barbados, 200 fathoms.

Ophioglypha variabilis Lym.

Specimens from about thirty stations showed a good deal of variation. Some were like Fig 70, Pl. III., Bull. M. C. Z. V., No. 7, while others had two or three vertical rows of scales in the lower interbrachial spaces. The scales on the back of the disk also varied in size and number. Likewise the second or under arm-comb had sometimes numerous and sometimes very few papillæ.

Station 101, Morro Light, 175–250 fathoms. Station 130, Frederickstadt, 451 fathoms. Station 136, Frederickstadt, 508 fathoms. Station 137, Frederickstadt, 625 fathoms. Station 148, St. Kitts, 208 fathoms. Station 161, Guadeloupe, 583 fathoms. Station 162, Guadeloupe, 734 fathoms. Station 163, Guadeloupe, 769 fathoms. Station 173, Guadeloupe, 734 fathoms. Station 174, Guadeloupe, 878 fathoms. Station 175, Dominica, 608 fathoms. Station 179, Dominica, 824 fathoms. Station 185, Dominica, 333 fathoms. Station 188, Dominica, 372 fathoms. Station 200, Martinique, 472 fathoms. Station 208, Martinique, 213 fathoms. Station 221, St. Lucia, 423 fathoms. Station 226, St. Vincent, 424 fathoms. Station 227, St. Vincent, 573 fathoms. Station 228, St. Vincent, 785 fathoms. Station 230, St. Vincent, 464 fathoms. Station 239, Grenadines, 338 fathoms. Station 257, Grenada, 553 fathoms. Station 260, Grenada, 291 fathoms. Station 264, Grenada, 416 fathoms. Station 265, Grenada, 576 fathoms.

Ophioglypha irrorata ? Lym.

The specimens seemed just the same as those from Station 164 of the "Challenger" (Bull. M. C. Z., V., No. 7, p. 74). They differed from those from the coast of Portugal, called *O. irrorata* (?) in the postscript to my Challenger Ophiuroidea (p. 381), in having three arm-spines set close together, whereas the latter had two below, and one separated and higher up ; while farther out they were close together, and the middle one had the form of a blunt hook.

Station 140, Virgen Gorda, 1,097 fathoms. Station 245, Grenada, 1,058 fathoms.

Ophioglypha convexa ? Lym.

Plate IV. Figs. 40-45.

Most of the specimens differ so much from *O. convexa* as to appear like another species. The six primary plates, extremely swollen, form an elevated rosette, overhanging very small radial shields, not so large as the head of the genital scale. The mouth-shield, too, occupies the *whole* of the lower interbrachial space (fig. 43). But specimens from Station 148 were intermediate, or rather differed from the typical form only in finer arm-comb papillæ and more interbrachial scales on the disk margin. It will be necessary to await further dredgings before deciding the specific limits. It is to be noted as an important difference, that, while the typical *O. convexa* is found in 2,350 fathoms, this species does not go below 240 fathoms.

Station 145, St Kitts, 270 fathoms. Station 157, Montserrat, 120 fathoms. Station 158, Montserrat, 148 fathoms. Station 220, St. Lucia, 116 fathoms. Station 224, St. Vincent, 114 fathoms.

Ophiocten Pattersoni sp. nov.

Plate IV. Figs. 46-48.

Special Marks. — Longest arm-spine as long as one and a half arm-joints. Disk covered above irregularly with larger and smaller scales. Arm-comb feeble. One wide mouth-papilla on each side, and two spiniform farther in, with one at apex of mouth-angle.

Description of an Individual. — Diameter of disk 9.5 mm. Width of arm close to disk 1.6 mm. A very wide papilla at outer corner of mouth-angle, and two spiniform within it, on either side, and one or two at the apex. Three slender, spike-like teeth. Mouth-shields rounded squarish, as broad as long, with an ill-marked angle within ; length to breadth, 1.2 : 1.2. Side mouth-shields very narrow, of equal width, meeting fully within. First under arm-plate large, about as broad as long, of a rudely rhomboidal form, with a rounded angle outward ; the rest are much wider than long, with a rounded angle without, a little peak within, and sharp lateral corners. Side arm-plates slightly flaring outward, meeting broadly below, where they cover most of the arm; separated above by the upper arm-plates, which are much broader than long, and a little wider without than within ; length to breadth, .8 : 1.5. Disk circular and flat on top, where it is covered with fine, thin scales, among which appear numerous irregular plates, which form a continuous patch at the margin. Radial shields small, irregular, and widely separated. Interbrachial spaces below covered by a more regular imbricated scaling, and without plates. Genital scales hidden, except their outer ends, just outside the radial shields, which bear a feeble arm-comb of half a dozen or less minute papillæ. Tentacle-pores large ; the outer ones are furnished with a small scale, which often is lacking on the basal pores. Three very slender, tapering arm-spines, the uppermost and longest one as long as one and a half or two joints. Color in alcohol, pale yellowish gray.

Station 344, Lat. 40° 1′ N., Long. 70° 58′ W., 129 fathoms, 1 specimen.

Ophiomusium eburneum Lym.

Bull. M. C. Z., I. 10, p. 322, 1869. Ill. Cat. M. C. Z., VI., Pl. II. figs. 1, 2, 3.

It happened strangely enough that the specimen originally described by me was only half grown and aberrant, differing from ordinary specimens somewhat in the comparative thinness of the disk scales, but chiefly in the narrowness of the arm, which was only 1.3 mm., while an average individual with a similar disk (9 mm.) would have an arm 2 mm. wide. I found, however, one or two whose arms were not much wider than those of the type.

This species attains a good size. One with a disk of 15 mm. had arms about 50 mm. long and 3 mm. wide. The radial shields were more elongated than in the type, and there were three little arm-spines.

In looking over a large series, there may be found some difference in the form of the radial shields, in the size and thickness of the fine central scales of the disk, in the length and number of the arm-spines, which may be two or three, and in the width of the arm.

Constant features are the somewhat swollen and microscopically tuberculous side arm-plates, the numerous and comparatively thin disk scales, and the presence of only *two* under arm-plates furnished with tentacles.

Station 100, off Morro Light, 250–400 fathoms. Station 132, Santa Cruz, 115 fathoms. Station 147, St. Kitts, 250 fathoms. Station 159, Guadeloupe, 196 fathoms. Station 176, Dominica, 390 fathoms. Station 177, Dominica, 118 fathoms. Station 185, Dominica, 333 fathoms. Station 208, Martinique, 213 fathoms. Station 215, St. Lucia, 226 fathoms. Station 218, St. Lucia, 164 fathoms. Station 231, St. Vincent, 95 fathoms. Station 238, Grenadines, 127 fathoms. Station 240, Grenadines, 164 fathoms. Station 241, Grenadines, 163 fathoms. Station 248, Grenada, 161 fathoms. Station 249, Grenada, 262 fathoms. Station 258, Grenada, 159 fathoms. Station 262, Grenada, 92 fathoms. Station 263, Grenada, 159 fathoms. Station 269, St. Vincent, 124 fathoms. Station 274, Barbados, 209 fathoms. Station 280, Barbados, 221 fathoms.

Ophiomusium Lymani Wyv. Thom.

Plate V. Figs. 55-57. (Young.)

The young, with a disk not larger than 5 mm., would be taken for a new species. On the back is an elevated rosette of thick primary plates, each having a central boss. Outside these lie the thick radial shields, and, in the interbrachial spaces, two plates, the marginal one much the larger. Below, it has, besides the genital scales, one large plate outside the mouth-shield, and two or three very small ones on the margin. With a disk of 8 mm. it resembles the adult of *O. validum*, of the same size, except that the latter has larger radial shields, fewer central scales, and, below, scarcely more than one great plate outside the mouth-shield.

Station 331, 35° 44′ 40″ N., 74° 40′ 20″ W., 898 fathoms.

The following were adult: —

Station 305, 41° 33′ 15″ N., 65° 51′ 25″ W., 810 fathoms. Station 307, 41° 29′ 45″ N., 65° 47′ 10″ W., 980 fathoms. Station 308, 41° 24′ 45″ N., 65° 35′ 30″ W., 1242 fathoms. Station 330, 31° 41′ N., 74° 35′ W., 1047 fathoms. Station 331, 35° 44′ 40″ N., 74° 40′ 20″ W., 898 fathoms. Station 338, 38° 18′ 40″ N., 73° 18′ 10″ W., 922 fathoms. Station 339, 38° 16′ 45″ N., 73° 10′ 30″ W., 1186 fathoms. Station 341, 39° 38′ 20″ N., 70° 56′ W., 1241 fathoms. Station 342, 39° 43′ N., 70° 55′ 25″ W., 1002 fathoms.

Ophiomusium validum Ljn.

Station 100, off Morro Light, 250–400 fathoms. Station 101, off Morro Light, 175–200 fathoms. Station 117, Porto Rico, 874 fathoms. Station 131, Santa Cruz, 580 fathoms. Station 134, Santa Cruz, 248 fathoms. Station 145, St. Kitts, 270 fathoms. Station 146, St. Kitts, 245 fathoms. Station 148, St. Kitts, 208 fathoms. Station 149, St. Kitts, 60–180 fathoms. Station 161, Guadeloupe, 583 fathoms. Station 162, Guadeloupe, 734 fathoms. Station 163, Guadeloupe, 769 fathoms. Station 173, Guadeloupe, 734 fathoms. Station 174, Guadeloupe, 878 fathoms. Station 175, Dominique, 608 fathoms. Station 190, Dominique, 542 fathoms. Station 195, Martinique, 501 fathoms. Station 200, Martinique, 472 fathoms. Station 211, Martinique, 357 fathoms. Station 212, Martinique, 317 fathoms. Station 222, St. Lucia, 422 fathoms. Station 227, St. Vincent, 573 fathoms. Station 228, St. Vincent, 785 fathoms. Station 238, Grenadines, 127 fathoms. Station 257, Grenada, 553 fathoms. Station 259, Grenada, 159 fathoms. Station 261, Grenada, 340 fathoms. Station 264, Grenada, 416 fathoms. Station 291, Barbados, 200 fathoms. Bartlett, Station 4, 20° 24′ 15″ N., 73° 56′ 50″ W., 772 fathoms. Bartlett, Station 8, 17° 45′ N., 77° 58′ 40″ W., 322 fathoms. Bartlett, Station 18, 18° 20′ 30″ N., 87° 16′ 40″ W., 600 fathoms.

Ophiomusium testudo Lym.

Station 100, off Morro Light, 250–400 fathoms. Station 132, Frederickstadt, 115 fathoms. Station 136, Frederickstadt, 508 fathoms. Station 155, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 158, Montserrat, 148 fathoms. Station 177, Dominique, 118 fathoms. Station 178, Dominique, 130 fathoms. Station 224, St. Vincent, 114 fathoms. Station 232, St. Vincent, 88 fathoms. Station 262, Grenada, 92 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms. Station 290, Barbados, 73 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiomusium planum Lym.

Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiomusium acuferum Lym.

Station 132, Santa Cruz, 115 fathoms. Station 143, Saba Bank, 150 fathoms. Station 149, St. Kitts, 60–180 fathoms. Station 142, Flannegan Passage, 27 fathoms. Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 167, Guadeloupe, 175 fathoms. Station 177, Dominica, 118 fathoms. Station 196, Martinique, 1030 fathoms. Station 206, Martinique, 170 fathoms. Station 210, Martinique, 191 fathoms. Station 220, St. Lucia, 116 fathoms. Station 224, St. Vincent, 114 fathoms. Station 231, St. Vincent, 95 fathoms. Station 233, St. Vincent, 174 fathoms. Station 253, Grenada, 92 fathoms. Station 254, Grenada, 164 fathoms. Station 262, Grenada, 92 fathoms. Station 269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 274, Barbados, 209 fathoms. Station 276, Barbados, 94 fathoms. Station 277, Barbados, 106 fathoms. Station 278, Barbados, 69 fathoms. Station 281, Barbados, 288 fathoms. Station 290, Barbados, 73 fathoms. Station 291, Barbados, 200 fathoms. Station 292, Barbados, 56 fathoms. Station 293, Barbados, 82 fathoms. Station 296, Barbados, 84 fathoms. Station 297, Barbados, 123 fathoms. Station 299, Barbados, 140 fathoms. Station 300, Barbados, 82 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms. Entrance to Port Royal, Jamaica, 100 fathoms.

Ophiomusium serratum Lym.

Station 136, Frederickstadt, 508 fathoms. Station 140, Virgen Gorda, 1097 fathoms. Station 205, Martinique, 334 fathoms. Station 211, Martinique, 357 fathoms. Station 214, Martinique, 476 fathoms. Station 230, St. Vincent, 464 fathoms. Station 260, Grenada, 291 fathoms. Station 269, St. Vincent, 124 fathoms. Station 274, Barbados, 209 fathoms. Station 280, Barbados, 221 fathoms. Station 288, Barbados, 399 fathoms. Bartlett, Station 8, 17° 45′ N., 77° 58′ 40″ W., 322 fathoms. Bartlett, Station 24, 5 m. E. of Cape Cruz, S. side of Cuba, 206 fathoms.

Ophiomastus texturatus sp. nov.

Plate IV. Figs. 49-51.

Special Marks. — Three minute arm-spines. Disk covered above by a central rosette of eleven plates, from which radiate ten single lines of plates. Radial shields large and oblong.

Description of an Individual. — Diameter of disk 4.7 mm. Width of arm, near disk, 1.7 mm. A row of four or five small, block-like papillæ on each side of a mouth-angle ; they are so closely wedged together as to form an apparently continuous line. Teeth resembling mouth-papillæ in form and size. Mouth-shields small, as broad as long, bounded by a curve without and an angle within ; length to breadth, .7 : .7. Side mouth-shields pointed, oval, large, widely joined within. Under arm-plates small, occupying less than one third the width of the arm, five-sided, with outer edge curved, laterals re-enteringly curved, and an angle within. Side arm-plates very large, meeting above and below, and covering the greater part of the broad arm. Upper arm-plates small, occupying little more than a third of the width of arm, transverse oval. The surface of the arm, as well as that of the disk, is microscopically tuberculous. Disk covered above by swollen plates, of which there is a central rosette of eleven ; one ten-sided in the midst, and surrounding it ten hexagonal, with unequal sides, whereof the brachial plates are the largest ; all are continued, by single rows of small plates, to margin of disk. Below, the interbrachial space is occupied by large, thick genital plates, and by two others placed on the median line. Radial shields large, longer than broad, wider without than within, where they join the central rosette ; length to breadth, 1.2 : .9. Genital openings narrow and very short, beginning at outer corner of radial shield. Three very small peg-like arm-spines, less than half as long as a joint. Second pair of mouth-tentacles issuing from pores just inside the side mouth-shields ; first pair of arm-tentacles with three minute, lip-like scales ; those beyond usually with only one small scale. Color in alcohol, pale gray.

"Challenger" Expedition, Station 173, 310 fathoms, 1 specimen.

Ophiomastus secundus Lym.

Station 136, Santa Cruz, 508 fathoms. Station 149, St. Kitts, 60–150 fathoms. Station 163, Guadeloupe, 769 fathoms. Station 179, Dominica, 824 fathoms. Station 180, Dominica, 982 fathoms. Station 182, Dominica, 1131 fathoms. Station 185, Dominica, 333 fathoms. Station 196, Martinique, 1030 fathoms. Station 205, Martinique, 334 fathoms. Station 211, Martinique, 357 fathoms. Station 230, St. Vincent, 464 fathoms. Station 288, Barbados, 399 fathoms. Station 325, 33° 35′ 20″ N., 76° W., 647 fathoms. Station 326, 33° 42′ 15″ N., 76° 0′ 50″ W., 464 fathoms. Station 329, 34° 39′ 40″ N., 75° 14′ 40″ W., 603 fathoms.

Ophiophyllum petilum ? Lym.

Bull. M. C. Z., V. 7, p. 130, Pl. VII. Figs. 179–181.

Plate IV. Figs. 52-54.

The single specimen brought up from 542 fathoms at Station 190, near Dominica, differed from the type in having, near the base of the arm, a small, peg-like, additional arm-spine, standing just above the peculiar flat, curved, translucent spine, which seems like a continuation of the free plates which border the disk. Also there were not so many plates in the lower brachial space. All the disk plates were thin and more or less diaphanous, so that their outlines were hard to make out unless the specimen was partly dried. These differences may be constant and specific ; but I prefer to leave them in doubt because only one adult specimen of the typical *O. petilum* was brought back by the "Challenger."

There is a certain resemblance in some parts of the Ophiuran fauna of the Fijis from depths of 200 to 600 fathoms to that of the West Indies at the same depths. From the former we now have *Astroschema salix* and *horridum*, (?) *Ophioceramis clausa*, *Ophiactis cuspidata*, *O. flexuosa*, *O. nama*, *Amphiura canescens*, *A. argentea*, *A. bellis*, *Ophiomitra plicata*, *Ophiacantha cornuta*, *O. vepratica*, *Ophiophyllum petilum*, *Ophiochiton lentus*, *Ophiomusium scalare*, *Ophioconis pulverulenta*, *Ophiopyrgus Wyville-Thomsoni*, *Ophiopyren brevispinus*, *Ophiozona insularia*, and *Ophiomyxa australis*. Of these *Ophiophyllum petilum*, *Ophiacantha vepratica*, and *Ophioconis pulverulenta* correspond very closely with the Ophiophyllum above mentioned, with *Ophiacantha Bairdi*, and with *Ophioconis miliaria*. In both faunæ is found exclusively the peculiar genus Ophiopyren, and Ophiozona exists in both. *Ophiomusium scalare* and *Ophiomitra plicata* stand pretty near *Ophiomusium testudo* and *Ophiomitra chelys*. The genus Astroschema, so richly represented in the West Indies, has two species in this list of twenty. As a contrast comes the extraordinary form Ophiopyrgus, known thus far only from the neighborhood of the Fijis. It remains for future dredgings to show whether these resemblances result probably from community of origin, or simply indicate the presence of a nearly identical fauna over vast tracts of deep-sea bottom.

Ophiopyren longispinus Lym.

Station 130, Santa Cruz, 451 fathoms. Station 136, Santa Cruz, 508 fathoms. Station 137, Santa Cruz, 625 fathoms. Station 149, St. Kitts, 60–150 fathoms. Station 156, Montserrat, 88 fathoms. Station 185, Dominica, 333 fathoms. Station 188, Dominica, 372 fathoms. Station 190, Dominica, 542 fathoms. Station 204, Martinique, 476 fathoms. Station 205, Martinique, 334 fathoms. Station 211, Martinique, 357 fathoms. Station 212, Martinique, 317 fathoms. Station 221, St. Lucia, 423 fathoms. Station 222, St. Lucia, 422 fathoms. Station 230, St. Vincent, 464 fathoms. Station 246, Grenada, 154 fathoms. Station 260, Grenada, 291 fathoms. Bartlett, Station 18, 18° 20′ 30″ N., 87° 16′ 40″ W., 600 fathoms.

Ophioconis miliaria Lym.

Station 187, Dominica, 411 fathoms. Station 222, St. Lucia, 422 fathoms. Station 241, Grenadines, 163 fathoms. Station 260, Grenada, 291 fathoms.

Ophiochœta mixta Lym.

Station 170, Guadeloupe, 309 fathoms. Station 249, Grenada, 262 fathoms. Station 265, Grenada, 576 fathoms.

Ophiopholis aculeata Gray.

Station 309, 40° 11′ 40″ N., 68° 22′ W., 304 fathoms. Station 310, 39° 59′ 16″ N., 70° 18′ 30″ W., 260 fathoms. Station 335, 38° 22′ 25″ N., 73° 33′ 40″ W., 89 fathoms.

Ophiactis Mülleri (var. quinqueradia) Ltk.

Station 142, Flannegan Passage, 27 fathoms. Station 152, St. Kitts, 122 fathoms. Station 210, Martinique, 121 fathoms. Station 239, Grenadines, 338 fathoms. Station 272, Barbados, 76 fathoms. Station 278, Barbados, 69 fathoms.

Amphiura incisa sp. nov.

Plate V. Figs. 58-60.

Special Marks. — Two scale-like papillæ on each side of mouth-angle, and a pair at its apex. Two large tentacle-scales. Upper disk-scales thick and irregular and separated by depressions.

Description of an Individual. — Diameter of disk 7.5 mm. Width of arm close to disk 1.7 mm. Two wide, scale-like papillæ at base of mouth-angle on either side, and a pair of thicker ones at its apex. Four stout squarish teeth; the lowest one smallest and more rounded than those above. Mouth-shields small, rounded, and with a peak inward; length to breadth, .7 : .7. Side mouth-shields long and large; broader without than within, where they meet. First under arm-plate small and rounded; often partly covered by the outer mouth-papillæ. The plates beyond are of a regular narrow shield-shape, having a straight outer side where they are widest; re-enteringly curved laterals, and an angle within. Side arm-plates flat, with a low spine-ridge, barely meeting above, and scarcely separated below. Upper arm-plates separated; narrow transverse oval, more than twice as broad as long. Disk rather thick, with an undulating border; covered above by thick, irregular, somewhat angular scales, which are separated by sunken lines, and have the look of a loose mosaic. Below, the scales are smaller and much more rounded and regular, but are strongly separated. Radial shields small, pear-seed shape, and separated by a narrow wedge of three scales; length to breadth, 1.5 : 1. Three stout, blunt, rounded arm-spines, about as long as a joint; the middle one is stoutest and has a microscopically rough surface. Two wide, large tentacle-scales, standing one on the side and one on the under arm-plate. Color in alcohol, pale brown.

Station 161, near Guadeloupe, 583 fathoms, 2 specimens.

This species is nearest *A. Riisei*, from which it is strongly distinguished by separated upper arm-plates and radial shields, and much coarser arm-spines and disk-scales.

Amphiura nereis sp. nov.

Plate V. Figs. 61-63.

Special Marks. — Five papillæ on each side of a mouth-angle. Three arm-spines. Radial shields small, narrow and separated. A row of minute papillæ along genital scale.

Description of an Individual. — Diameter of disk 4.5 mm. Width of arm without spines 1 mm. Four small scale-like mouth-papillæ on each side of an angle, and a pair at the apex. The papilla next the outermost one is commonly the largest. Mouth-shields about as broad as long, rounded, with a slight peak within ; length to breadth, .6 : .6. Side mouth-shields small, and extremely narrow within, where they barely meet. Their outer ends are club-shaped. First under arm-plate minute and three-cornered ; those beyond are of a squarish shield-shape, with outer side straight, laterals a little re-ënteringly curved, and an obtuse or truncated angle within. Side arm-plates moderately stout, and nearly meeting above and below. Upper arm-plates transverse oval, and about twice as broad as long. Disk rather thick, and covered above and below with small, crowded, overlapping, somewhat irregular scales, of which there are seven or eight in the length of 1 mm. In centre of upper surface are the small, round, widely separated primary plates. Along edge of genital scale is a row of fine papillæ. Radial shields small, narrow, and separated by bunches of scales ; their length is about .8 mm. Three rather stout, rounded, tapering arm-spines, about as long as a joint ; the middle one being somewhat the longest. One oval tentacle-scale on the side arm-plate, and a smaller and narrower one on the under plate. Color in alcohol, pale gray.

Station 158, Montserrat, 148 fathoms, 1 specimen.

This species is perhaps nearest to *A. tumida*, from which it differs in having much larger mouth-papillæ, and a row of papillæ along the genital scale.

Amphiura duplicata Lym.

Station 132, Santa Cruz, 115 fathoms. Station 134, Santa Cruz, 248 fathoms. Station 136, Santa Cruz, 508 fathoms. Station 145, St. Kitts, 270 fathoms. Station 147, St. Kitts, 250 fathoms. Station 148, St. Kitts, 208 fathoms. Station 151, Nevis, 356 fathoms. Station 154, Montserrat, 298 fathoms. Station 155, Montserrat, 88 fathoms. Station 161, Guadeloupe, 583 fathoms. Station 167, Guadeloupe, 175 fathoms. Station 173, Guadeloupe, 734 fathoms. Station 176, Dominica, 390 fathoms. Station 185, Dominica, 333 fathoms. Station 204, Martinique, 476 fathoms. Station 206, Martinique, 170 fathoms. Station 210, Martinique, 191 fathoms. Station 216, St. Lucia, 154 fathoms. Station 218, St. Lucia, 164 fathoms. Station 220, St. Lucia, 116 fathoms. Station 221, St. Lucia, 423 fathoms. Station 227, St. Vincent, 573 fathoms. Station 238, Grenadines, 127 fathoms. Station 239, Grenadines, 338 fathoms. Station 241, Grenadines, 163 fathoms. Station 260, Grenada, 291 fathoms. Station 261, Grenada, 340 fathoms. Station 264, Grenada, 416 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 274, Barbados, 209 fathoms. Station 275, Barbados, 218 fathoms. Station 276, Barbados, 94 fathoms. Station 290, Barbados, 73 fathoms.

Amphiura Otteri Ljn.

Station 115, 17° 55′ N., 76° 41′ 20″ W., 228 fathoms. Station 167, Guadeloupe, 175 fathoms. Station 265, Grenada, 576 fathoms. Station 306, 41° 32′ 50″ N., 65° 55′ W., 524 fathoms. Station 310, 39° 59′ 16″ N., 70° 18′ 30″ W., 260 fathoms. Station 336, 38° 21′ 50″ N., 73° 32′ W., 197 fathoms.

Amphiura tumida Lym.

Station 184, Dominica, 94 fathoms.

Amphiura tenuispina Ljn.

Station 215, St. Lucia, 226 fathoms. Station 223, St. Vincent, 146 fathoms. Station 246, Grenada, 154 fathoms.

Amphiura lunaris Lym.

Station 226, St. Vincent, 424 fathoms.

Amphiura grandisquama Lym.

Station 316, 32° 7′ N., 78° 37′ 30″ W., 229 fathoms. Station 319, 32° 25′ N., 77° 42′ 30″ W., 262 fathoms.

Amphiura flexuosa ? Ljn.

Station 319, 32° 25′ N., 77° 42′ 30″ W., 262 fathoms.

Amphiura cuneata Lym.

Station 256, Grenada, 370 fathoms. Station 259, Grenada, 159 fathoms.

Amphiura Stimpsoni Ltk.

Station 278, Barbados, 69 fathoms.

NOTES ON AMPHIURA.

Amphiura sp. nov. ?

Near *A. semiermis*, but has disk-scales much larger and fewer, and two *large* tentacle-scales. There are five short, tapering equal arm-spines. The lower interbrachial space is naked, except a few scales near the mouth-shields.

Station 244, near Grenada, 792 fathoms, 1 specimen.

Amphiura sp. nov. ?

Near *A. divaricata*, from which it differs in having radial shields scarcely separated, in coarser lower disk-scales, in having a larger tentacle-scale on the under arm-plate, and in having five (not six) arm-spines, of which the lower are larger, and have a rudimentary cross-piece at the tip.

Station 211, Martinique, 357 fathoms, 1 specimen.

Amphiura sp. nov.?

Plate V. Figs. 64-66.

Similar to preceding (Station 211), but with much smaller tentacle-scales; sharp mouth-papillæ.

Station 220, St Lucia, 116 fathoms, 1 specimen.

These last three species may be new; but as the Amphiuræ are so numerous and run so close, I prefer to await a larger series of specimens.

Amphiura Verrilli? (young,) Lym.

Differs from the type in having smaller radial shields and the primary disk-plates not conspicuous.

Station 226, St. Vincent, 424 fathoms, 1 specimen.

Amphiura tomentosa? (young,) Lym.

Differs from the original in having the radial shields touching and side arm-plates meeting above. These may be characters of the young.

Station 230, St. Vincent, 464 fathoms, 1 specimen.

Amphiura angularis Lym.

It seems to differ from the type only in having radial shields a little closer and the disk-scaling less marked. Both *A. angularis* and *A. tomentosa* are from the Kerguelen Islands.

Station 204, Martinique, 476 fathoms, 1 specimen. Station 288, Barbados, 399 fathoms, 1 specimen.

Ophiocnida olivacea Lym.

Station 344, 40° 1′ N., 70° 58′ W., 129 fathoms.

Ophionema intricata Ltk.

(Young.) Station 128, Santa Cruz, 180 fathoms.

Ophionereis reticulata Ltk.

Station 142, Flannegan Passage, 27 fathoms. Station 155, Montserrat, 88 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms. Bartlett, Pedro Bank, 4 fathoms.

Ophiopsila fulva Lym.

Station 155, Montserrat, 88 fathoms. Station 278, Barbados, 69 fathoms.

Ophiopsila Riisei Ltk.

Station 285, Barbados, 13–40 fathoms. Station 287, Barbados, 7½–50 fathoms.

Ophioplax Ljungmani Lym.

Station 101, Morro Light, 175–250 fathoms. Station 132, Santa Cruz, 115 fathoms. Station 155, Montserrat, 88 fathoms Station 156, Montserrat, 88 fathoms. Station 177, Dominique, 118 fathoms. Station 220, St. Lucia, 116 fathoms. Station 232, St. Vincent, 88 fathoms. Station 273, Barbados, 103 fathoms. Station 277, Barbados, 106 fathoms. Station 297, Barbados, 123 fathoms. Bartlett, Station 10, 18° 13′ 20″ N., 78° 36′ 40″ W., 103 fathoms.

Ophiostigma isacanthum Lym.

Station 132, Santa Cruz, 115 fathoms. Station 152, St. Kitts, 122 fathoms.

Ophiochytra tenuis sp. nov.

Plate III. Figs. 16-18.

Special Marks. — Two very large scale-like papillæ at outer end of mouth-angle, and two small ones, within and higher in the slit. A few grains in neighborhood of mouth-shield.

Description of an Individual. — Diameter of disk 5 mm. Width of arm near disk 1 mm. At outer end of mouth-angle on either side are two large, flat, rounded scale-like papillæ, while within and higher on the mouth-frame may be seen two which are minute. At base of mouth-frames, in the centre, is a group of half a dozen grains, covering inner ends of the side mouth-shields, which are long, narrow and bent; wider without than within where they fully join and extend as a sharp angle under the mouth-frames to a level with the second great mouth-papilla. Mouth-shields small, about as long as broad, with a well-marked angle inward ; length to breadth, .5 : .6. First under arm-plate smaller than those beyond, and making a furrow at outer corner of mouth-slit. The plates just beyond are axe-shaped with a curve without, an angle within, and deep re-entering curves where the tentacles protrude. Side arm-plates meeting above and nearly so below ; beyond the disk they are a little swollen so as to give a slightly wavy outline to the arm. Upper arm-plates fan-shaped, with an angle inward. Disk evenly covered with thin imbricated scales, whereof the lower ones are nearly as large as the mouth-shields, near which are a few grains. Radial shields small and not touching; nearly twice as wide as long, and separated from upper surface of arm by a cluster of scales. Genital openings extending from mouth-shield to margin of disk. Two stout, cylindrical, blunt arm-spines, about two thirds as long as a joint. One large circular tentacle-scale. Color in alcohol, pale gray.

Station 239, Grenadines, 383 fathoms, 6 specimens. Station 260, Grenada, 291 fathoms, 5 specimens.

The only other species of this genus, *O. epigrus*, comes from Low Archipelago, southeast of the Sandwich Islands, at a depth of over 2500 fathoms.

Ophiocoma pumilla Ltk.

Bartlett, Pedro Bank, 4 fathoms.

Ophiochiton ternispinus sp. nov.

Plate V. Figs. 67-69.

Special Marks. — One tentacle-scale. Three slender, rather long arm-spines.

Description of an Individual. — Diameter of disk 12 mm. Length of arm 60 mm. Width of arm near disk 2 mm. Twelve mouth-papillæ to each angle, whereof the four inner ones, on either side, are short, pointed and spaced, while the two outer ones are flattened and crowded. Teeth stout, flat, and shaped like a blunt spear-head. Mouth-shields regular pointed heart-shaped, with a small rounded lobe without. Length to breadth, 2 : 1.3. Side mouth-shields very narrow within, where they barely meet; but spreading widely without, where they bound a part of the inner end of the genital opening. First under arm-plate rounded and small, not larger than the neighboring mouth-papilla. The plates beyond are much narrower than the arm; they are about as broad as long, much wider without than within, with an outer curve, re-entering curves on the sides, and a truncated angle within. They are somewhat swollen, but have no ridge. Side arm-plates even, slightly flaring, nearly meeting above and below. Upper arm-plates narrower than the arm, much longer than wide, bounded on all sides by gentle curves. Disk covered with thin, irregular, overlapping scales, and having in the centre a group of much larger rounded primary plates, 1 mm. in diameter. Below, the scaling is similar but finer. Radial shields narrow oblong, or egg-shape, small, separated by a narrow wedge of fine scales; length to breadth, 2 : 1. Genital openings large and long, extending from mouth-shield to margin of disk. Three smooth, slender, tapering arm-spines, whereof the uppermost may be as long as two joints. Lengths, to that of an under arm-plate, 2.5, 1.2, 1.2 : 1. One oval tentacle-scale of moderate size. Color in alcohol, nearly white.

"Porcupine" Expedition, 1869, Station 42, southwest of Ireland, 862 fathoms, water 4°.3 Cent., 1 specimen.

The genus is new to North European waters. The species differs from *Ophiochiton lentus*, which comes from 600 fathoms, southeast of the Fijis, in having three long slender arm-spines and only one tentacle-scale.

Ophiacantha Bairdi sp. nov.

Plate V. Figs. 70-72.

Special Marks. — Disk closely and uniformly beset with elongated pointed granules, among which appear a few short scattered spines. Seven or eight slender, smooth, sharp arm-spines. Eleven mouth-papillæ to each angle.

Description of an Individual (Station 340). — Diameter of disk 9.5 mm. Length of arm about 45 mm. Width of arm close to disk 2 mm. Eleven papillæ to each mouth-angle, whereof the outer one on each side is broad and flat, with a rounded cutting edge, and the rest are much narrower and tooth-like, including the odd one at the apex. Five broad flat teeth with a curved cutting edge ; the uppermost one narrower than the others. Mouth-shields small, of a broad oval, or transverse heart-shape ; length to breadth, .8 : 1.2. Side mouth-shields rather large, growing suddenly wider at the outer end, meeting within. Under arm-plates pentagonal, with an obtuse angle within, lateral sides a little re-enteringly curved, and outer side widely curved. Upper arm-plates diamond-shape with the angles much rounded. Side arm-plates rather stout, nearly meeting above and below near base of arm. Near tip of arm the side plates meet broadly above and below, and have only a feeble spine-crest. The upper arm-plates are there three-sided with an angle inward. Disk slightly puffed ; closely and uniformly beset with elongated, pointed grains, among which stand a few scattered short spines. No scaling or radial shields visible. Seven or eight long, slender, pointed, not rough arm-spines. The uppermost one is usually short ; then the next three are as long as two or two and a half joints; the four lowest not much longer than one joint. One large, pointed, longer than broad tentacle-scale. Color in alcohol, nearly white.

Station 308, 41° 24′ 45″ N., 65° 35′ 30″ W., 1242 fathoms. Station 340, 39° 25′ 30″ N., 70° 58′ 40″ W., 1394 fathoms.

The species is quite near *O. vepratica*, from which it is distinguished by having eleven instead of seven mouth-papillæ to each angle, and by the elongated, pointed grains of the disk.

Ophiacantha Bartletti sp. nov.

Plate V. Figs. 73-75.

Special Marks. — Structure delicate, with narrow arms and four smooth, slender arm-spines. A few scattered spines on disk, whose scaling above is scarcely distinguishable. No tentacle-scales.

Description of an Individual. — Diameter of disk 12 mm. Length of arm about 75 mm. Width of arm 2 mm. Five spine-like, spaced mouth-papillæ on each side, of which four stand on the mouth-frames, and one on the side mouth-shield; there is in addition a pair which stand at the apex, on the jaw-plate. Five rather thin teeth, shaped like a blunt spear-head. Mouth-shields about as broad as long, of a much-rounded diamond-shape, with a sharp angle within; length to breadth, 1.6 : 1.6. Side mouth-shields very narrow within, where they meet, but spreading at their outer end, so as to partly embrace the mouth-shield. Under arm-plates somewhat longer than broad, of an irregular hexagonal form, with a slight notch without; they are small, and occupy not more than a third of the width of the arm. Side arm-plates meeting above and below, clinging close to arm and with a feeble spine-crest. Upper arm-plates about twice as broad as long, of a transverse diamond-shape, with outer angle rounded. Disk sparsely set with short spines, and covered by a skin which hides the thin scales, except here and there. Of radial shields only the outer, rounded ends may be seen, just over the arms.. Genital openings large and extending from mouth-shield nearly to margin of disk. Four slender, smooth, tapering, translucent arm-spines, decreasing in length from above downward, the uppermost one being as long as two joints, while the lowest does not exceed one. No tentacle-scales. Color in alcohol, disk pale gray, arms white.

Station 260, 291 fathoms, 1 specimen.

In wanting tentacle-scales this species is especially distinguished. It stands as near to *O. abnormis* as to any other, but differs in having only four arm-spines and in the arrangement of the mouth-papillæ.

Ophiacantha cervicornis sp. nov.

Plate V. Figs. 76-78.

Special Marks. — Mouth-angles elongated and carrying at their base long spiniform papillæ and small peg-like ones at their apex. Arm-spines wide at their base and toothed on the edges. Disk densely beset with short smooth spines.

Description of an Individual (Station 227). — Diameter of disk 10 mm. Width of arm near disk 2.3 mm. Mouth-angle much elongated and bearing on either side, at its base, four long, pointed spiniform papillæ, inside which there are, on either side, five short, pointed tooth-like papillæ, and a pair at the apex. Mouth-shields of a transverse oval shape, with a small peak inward; length to breadth, 1 : 1.8. Side mouth-shields of moderate width, meeting within, where they form an acute angle. First under arm-plate much wider than long, with lateral corners rounded and a peak within. The plates beyond have a wide axe-shape, in which the body is narrow with an obtuse angle inward; the lateral sides are deep re-entering curves, and the cutting edge is represented by the broad, curved outer margin. Side arm-plates meeting below and nearly so above, and having a rather feeble spine-crest. The first two upper arm-plates bear a few small tooth-like spines, and are as broad as long, and bounded without by a gentle curve and within by a deep pointed one. Farther out the plates are more elongated and angular, and soon become long diamond-shape. Disk densely beset with short, rounded, pointed spines, which obscure the underlying scales and radial shields. Five flattened, tapering, pointed arm-spines, the two uppermost about as long as one and a half arm-joints, the three lowest somewhat shorter. They are lightly swollen at their base and bear a few minute thorns on their edges. Tentacle-pores large, and furnished with two long, slender spiniform scales, whereof one stands on the side arm-plate, the other on the under one. Color in alcohol, straw.

Station 148, St. Kitts, 208 fathoms. Station 227, St. Vincent, 573 fathoms.

The elongated mouth-angle bearing numerous papillæ places this species near *O. stimulea* and *O. hirsuta,* but it differs much from both those species, especially in the under arm-plates and tentacle-scales.

Ophiacantha lineolata sp. nov.

Plate VI. Figs. 79-81.

Special Marks. — A group of tooth-papillæ just under the teeth. Upper surface of disk wholly and thickly set with coarse grains and a few short spines. Eight or nine long, translucent, nearly smooth arm-spines.

Description of an Individual. — Diameter of disk 18 mm. Length of arm about 135 mm. Width of arm, without spines, 6 mm. At base of mouth-angle, on either side, are three or four rather long papillæ, whereof the two outer ones are wider and more flat; the point of the angle is beset by a cluster of a dozen spine-like papillæ which run upward to join the teeth. These last are seven or eight in number, rather narrow, crowded and with a curved cutting edge. Mouth-shields heart-shaped with an angle inward; length to breadth, 2 : 2. Side mouth-shields small, tapering to a point inward, where they meet. Under arm-plates squarish, wider than long, with lateral sides re-enteringly curved and a feeble angle within. Side arm-plates meeting below, but not above, and forming a stout, not very prominent spine-crest. Upper arm-plates narrow, four-sided; wider without than within; length to breadth, 1.3 : 1.3. Disk somewhat swollen in interbrachial spaces, thickly set with coarse grains, among which appear a few small spines; no radial shields visible, their position being granulated like the rest. Genital openings large and extending from mouth-shield to margin of disk. Eight or nine long translucent, nearly smooth arm-spines, decreasing in length from above downward; their cross-section is oval, and it is only on their edges that they have microscopic prickles; length of uppermost spine 11 mm.; of lowest, 4 mm. One large, oval, pointed tentacle-scale on each pore, except the first, which has two. Color in alcohol, pale brown, with white spines and a white line along upper side of arm.

This large and beautiful species has some relation to Ophiocamax in the cluster of tooth-papillæ at the end of the mouth-angle.

Station 148, St. Kitts, 208 fathoms, 1 specimen.

Ophiacantha lævipellis sp. nov.

Plate VI. Figs. 82-84.

Special Marks. — Disk naked, or with a few scattered grains. Side arm-plates meeting above and below. Seven or eight slightly thorny slender arm-spines.

Description of an Individual. — Diameter of disk 4.5 mm. Length of arm about 18 mm. Width of arm, without spines, 1.5 mm. Mouth-angles long and wide, and bearing on each side three spine-like, widely spaced papillæ, while the apex is occupied by the lowest tooth, which, like the four above it, is of a blunt spear-head shape. The first under arm-plate also carries on its inner edge two scale-like papillæ. Mouth-shields small, of a tranverse diamond-form with rounded corners; length to breadth, .7 : .5. Side mouth-shields wide and large, of almost a crescent shape, meeting broadly within. First under arm-plate rounded hexagonal and nearly as large as a mouth-shield; those beyond are widely separated by the side arm-plates, and are more than twice as wide as long, with a curve without and a small peak within. Side arm-plates meeting widely above and below, and forming a strong spine-ridge, which, farther out, becomes so exaggerated as to give the arm a knotted look. Upper arm-plates, beyond the first, of a blunt wedge form, with the point inward. Disk covered with small imbricated scales which are quite naked (in some specimens there are scattered grains). Radial shields pear-seed shaped ; length to breadth, .5 : .4. Genital openings large, and extending from the mouth-shield to nearly the margin of disk. Seven or eight glassy, flattened, slightly thorny arm-spines, of which the uppermost is two or two and a half times as long as a joint ; from this they grow shorter to the lowest spine, which is no longer than one joint. The uppermost spines on top of arm stand close to each other, on either side of the median line. One small, pointed tentacle-scale. Color in alcohol, pale brown.

Station 232, St. Vincent, 88 fathoms, 12+ specimens.

The figure of the upper surface is drawn from specimens of two varieties, a smooth and a granulated. The former is the more common. This species has some resemblance to *O. serrata*, but has narrower side mouth-shields and much less thorny arm-spines.

Ophiacantha scolopendrica sp. nov.

Plate VI. Figs. 85-87.

Special Marks. — Seven smooth arm-spines, of which the three lowest are much the smallest. Disk with a few scattered smooth grains, and small rounded radial shields.

Description of an Individual. — Diameter of disk 12 mm. Width of arm 3 mm. Six spaced and rather long mouth-papillæ to each angle. Five thick teeth, of a short oval shape. Mouth-shields very short and wide, rudely transverse oval in form ; length to breadth, 1 : 2.5. Side mouth-shields much longer than wide, of nearly equal width except at their outer ends where they taper ; they fully meet within. First under arm-plate of a transverse diamond-shape with rounded angles ; the next two are squarish, with a curved outer side ; those beyond are nearly semicircular, with a slight peak within ; all are narrow, occupying not more than one third the width of the arm. Side arm-plates stout and forming a well-marked spine-ridge ; they meet below and separate all except the first two upper arm-plates ; they, however, do not meet, and there is a pit between their upper ends ; also they are so short as to leave a band on sides of arm quite uncovered. Upper arm-plates transverse oval with somewhat pointed corners ; they are nearly twice as broad as long and cover only about half the width of the arm. Disk-scales very indistinct, except near radial shields, which are separated, small, short and rounded ; length to breadth, 1.3 : 2. Upper surface of disk sparsely set with smooth grains. Lower interbrachial space smooth and apparently with few or no scales. Genital openings large and extending from the mouth-shield to margin of disk. Seven arm-spines, of which the three lowest are very small, microscopically rough, and not longer than half a joint ; while the three uppermost are often as long as one and a half or two joints, stout, nearly cylindrical, and tapering to a blunt point. On some of the basal pores there is a minute tentacle-scale attached at the juncture of under and side arm-plates. Color in alcohol, pale brown.

"Challenger" Expedition, Station **235**, 34° 7′ N., 138° E., 565 fathoms. Water 3°.3 Cent. Mud. One specimen.

The species is nearest *O. tuberculosa;* but has seven instead of three arm-spines.

Ophiacantha anomala? G. O. Sars.

Station 306, 41° 32′ 50″ N., 65° 55′ W., 524 fathoms.

Ophiacantha bidentata Ljn.

Station 307, 41° 29′ 45″ N., 65° 47′ 10″ W., 980 fathoms. Station 308, 41° 24′ 45″ N., 65° 35′ 30″ W., 1242 fathoms. Station 324, 33° 27′ 20″ N., 75° 53′ 30″ W., 1386 fathoms. Station 338, 38° 18′ 40″ N., 73° 18′ 10″ W., 922 fathoms. Station 339, 38° 16′ 45″ N., 73° 10′ 30″ W., 1186 fathoms. Station 340, 39° 25′ 30″ N., 70° 58′ 40″ W., 1394 fathoms. Station 341, 39° 38′ 20″ N., 70° 56′ W., 1241 fathoms. Station 342, 39° 43′ N., 70° 55′ 25″ W., 1002 fathoms.

Ophiacantha abyssicola G. O. Sars.

Station 309, 40° 11′ 40″ N., 68° 22′ W., 304 fathoms.

Ophiacantha millespina Vll.

Station 303, 41° 34′ 30″ N., 65° 54′ 30″ W., 306 fathoms. Station 306, 41° 32′ 50″ N., 65° 55′ W., 524 fathoms.

Ophiacantha hirsuta Lym.

Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 212, Martinique, 317 fathoms. Station 215, St. Lucia, 226 fathoms. Station 223, St. Vincent, 146 fathoms. Station 232, St. Vincent, 88 fathoms. Station 268, Grenada, 955 fathoms. Station 269, St. Vincent, 124 fathoms. Station 273, Barbados, 103 fathoms. Station 293, Barbados, 82 fathoms. Station 300, Barbados, 82 fathoms. Entrance to Port Royal Harbor, Jamaica, 100 fathoms ; sp. ?

Ophiacantha sertata Lym.

Station 148, St. Kitts, 208 fathoms. Station 164, Guadeloupe, 150 fathoms. Station 187, Dominica, 411 fathoms. Station 208, Martinique, 213 fathoms. Station 240, Grenadines, 164 fathoms. Station 241, Grenadines, 163 fathoms. Station 249, Grenada, 262 fathoms. Station 274, Barbados, 209 fathoms. Station 280, Barbados, 221 fathoms. Station 291, Barbados, 200 fathoms. Station 297, Barbados, 123 fathoms.

Ophiacantha vepratica Lym.

Station 151, Nevis, 356 fathoms. Station 204, Martinique, 476 fathoms. Station 205, Martinique, 334 fathoms. Station 226, St. Vincent, 424 fathoms. Station 260, Grenada, 291 fathoms. Station 264, Grenada, 416 fathoms. Station 288, Barbados, 399 fathoms.

NOTES ON OPHIACANTHA.

Ophiacantha scutata Lym.

The numerous individuals brought back by the second "Blake" expedition show some variations from the original figure (Bull. M. C. Z., V. 9, Pl. I. Figs. 1–3). Usually the radial shields are not naked, but beset, like the rest of the disk, with minute stumps. There often is an extra mouth-papilla on each side ; and higher up in the mouth-slit there may be a pair of scales belonging to the second mouth-tentacles. This last feature exists also in *O. cosmica*, a kindred species, but readily distinguished by the wide separation of the lower arm-plates. *O. scutata* has commonly only one tentacle-scale on the first pore, as on those beyond.

Station 134, Santa Cruz, 248 fathoms. Station 147, St. Kitts, 250 fathoms.

Station 148, St. Kitts, 208 fathoms. Station 183, Dominica, 250 fathoms. Station 238, Grenadines, 127 fathoms. Station 239, Grenadines, 338 fathoms. Station 269, St. Vincent, 124 fathoms. Station 281, Barbados, 288 fathoms. Station 291, Barbados, 200 fathoms.

Ophiacantha echinulata Lym.

Sometimes the radial shields cannot be seen, as in the figure (Bull. M. C. Z., V. 9, Pl. I. Figs. 7–9), but are quite hidden by the short disk-spines.

Station 153, Montserrat, 303 fathoms. Station 174, Guadeloupe, 878 fathoms. Station 185, Dominica, 333 fathoms. Station 205, Martinique, 334 fathoms. Station 227, St. Vincent, 573 fathoms. Station 260, Grenada, 291 fathoms.

Ophiacantha pentacrinus Ltk.

A large specimen with a disk of 6 mm. had still only six arm-spines, and in general answered to the description (*O. meridionalis*, Bull. M. C. Z., I. 10, p. 324), except that there were sometimes four, instead of three, mouth-papillæ on a side, and the disk-crotchets were somewhat stouter.

Station 136, Santa Cruz, 508 fathoms. Station 137, Santa Cruz, 625 fathoms. Station 155, Montserrat, 88 fathoms. Station 167, Guadeloupe, 175 fathoms. Station 176, Dominica, 390 fathoms Station 185, Dominica, 333 fathoms. Station 188, Dominica, 372 fathoms. Station 195, Martinique, 502½ fathoms. Station 204, Martinique, 476 fathoms. Station 205, Martinique, 334 fathoms. Station 206, Martinique, 170 fathoms. Station 211, Martinique, 357 fathoms. Station 212, Martinique, 317 fathoms. Station 221, St. Lucia, 423 fathoms. Station 222, St. Lucia, 422 fathoms. Station 226, St. Vincent, 424 fathoms. Station 227, St. Vincent, 573 fathoms. Station 230, St. Vincent, 464 fathoms. Station 260, Grenada, 291 fathoms. Station 280, Barbados, 221 fathoms. Station 288, Barbados, 399 fathoms. Station 291, Barbados, 200 fathoms. Station 299, Barbados, 140 fathoms. Station 320, 32° 33′ 15″ N., 77° 30′ 10″ W., 257 fathoms.

O. cosmica is near this species, but has seldom less than eight arm-spines, while the disk-crotchets are coarser with a crown of more numerous thorns, and the side arm-plates are less prominent.

Ophiacantha stellata Lym.

This species differs from the two last-named in having shorter and more thorny arm-spines (indeed, the upper arm-spines, beyond the basal joints, are often scarcely longer than the lower); in larger upper arm-plates, and more strongly knotted arms ; and in coarser and more thorny stumps on the disk.

Station 155, Montserrat, 88 fathoms. Station 177, Dominica, 118 fathoms. Station 233, St. Vincent, 174 fathoms. Station 249, Grenada, 262 fathoms. Station 253, Grenada, 92 fathoms. Station 262, Grenada, 92 fathoms. Station

269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 290, Barbados, 73 fathoms. Station 292, Barbados, 56 fathoms. Station 293, Barbados, 82 fathoms.

Ophiacantha aspera Lym.

Station 100, off Morro Light, 250–400 fathoms. Station 156, Montserrat, 88 fathoms. Station 158, Montserrat, 148 fathoms. Station 166, Guadeloupe, 150 fathoms. Station 171, Guadeloupe, 183 fathoms. Station 219, St. Lucia, 151 fathoms. Station 240, Grenadines, 164 fathoms. Station 241, Grenadines, 163 fathoms. Station 249, Grenada, 262 fathoms. Station 269, St. Vincent, 124 fathoms. Station 283, Barbados, 237 fathoms. Station 290, Barbados, 73 fathoms.

Ophiacantha Troscheli Lym.

Station 269, St. Vincent, 124 fathoms. Station 290, Barbados, 73 fathoms.

Ophiolebes claviger ? Lym.

Station 306, 41° 32′ 50″ N., 65° 55′ W., 524 fathoms.

Ophiomitra incisa sp. nov.

Plate VI. Figs. 89, 90.

Special Marks. — Upper interbrachial spaces indented and covered by a double row of large plates. Radial shields large, scarcely depressed, and nearly or quite joined for their whole length. Two or more tentacle-scales on the first pore. Five slightly thorny arm-spines.

Description of an Individual (Station 131). — Diameter of disk 10 mm. Length of arm about 80 mm. Width of arm 3.5 mm. Four or five papillæ on each side of a mouth-angle ; the three inner ones being stout spiniform, while the outermost, which is wedged between the side mouth-shield and first under arm-plate, is thick, flattened and more or less curled upward. Mouth-shields of a transverse diamond-shape, with corners so rounded as often to approach an oval; length to breadth, 1.8 : 1.2. They are thick and horizontal, so that their border stands out quite sharply from the nearly vertical scaling of the interbrachial space. Side mouth-shields wide and short, not extending beyond the lateral corners of the mouth-shields, widest within, where they fully join. First under arm-plate small, of a diamond-shape with a curve without. The rest are five-sided; widest without, where they are curved, and having re-entering laterals and a very feeble angle within. They are separated by a depressed portion of the side arm-plates, which meet below, but not above, near disk, and form prominent spine-crests on the sides of the arms. Upper arm-plates thick, wider than long, bounded by a gentle curve without, and by a rounded angle or a deep curve within. Disk thick and rising well above the arms, with a very deep constriction and radiating furrow in each interbrachial space. The surface between the furrow and the radial shield is occupied on either side by four large curved plates running diagonally inwards. The central disk is covered by coarse, irregular plates, similar to those of the lower interbrachial spaces. All the upper surface except the radial shields is sparsely set with smooth stumps. Radial shields large and only a little sunken ; joined, except at their inner ends, which are separated by a scale ; they are rounded without, pointed within ; length to breadth, 3.5 : 1.4. Genital openings reaching from the mouth-shield nearly to margin of disk. Five flattened glassy arm-spines which are slightly thorny on their edges ; the upper one is much the longest, and may equal three or four joints, thence they decrease to the lowest, which is about the length of a joint. On the first tentacle-pore are three erect, thickened tentacle-scales ; on the other pores there is but a single thickened scale. Color in alcohol, pale straw.

Variations. — There sometimes are as many as six scales on the first tentacle-pore; and a small group of papillæ at outer corner of mouth-slit. The greatest number of arm-spines observed was six. It differs from *O. chelys* in having larger radial shields, which are joined and scarcely sunken (not at all in the young), in having three or more scales on the first tentacle-pore, and in more rounded under arm-plates. Most of the specimens mentioned under *O. chelys* (Bull. Mus. Comp. Zoöl., V. 7, p. 153, and 9, p. 231), as brought by the first "Blake" expedition, belong under this species, although one of them had seven spines. I am satisfied that the deep furrows in the disk are natural to the animal, and are not the result of contraction.

Station 124, Santa Cruz, 580 fathoms. Station 131, Santa Cruz, 580 fathoms. Station 175, Dominica, 608 fathoms. Station 190, Dominica, 542 fathoms. Station 204, Martinique, 476 fathoms. Station 205, Martinique, 334 fathoms. Station 211, Martinique, 357 fathoms. Station 214, Martinique, 476 fathoms. Station 222, St. Lucia, 422 fathoms. Station 227, St. Vincent, 573 fathoms. Station 266, Grenada, 461 fathoms. Station 288, Barbados, 399 fathoms.

Ophiomitra exigua ? Lym.

Station 100, off Morro Light, 250–400 fathoms. Station 270, St. Vincent, 75 fathoms. Station 296, Barbados, 84 fathoms.

Ophiomitra valida Lym.

Station 119, 18° 12′ N., 64° 55′ W., 1105 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 171, Guadeloupe, 183 fathoms. Station 175 (young), Dominica, 611 fathoms. Station 193, Martinique, 169 fathoms. Station 216, St Lucia, 154 fathoms. Station 218, St. Lucia, 164 fathoms. Station 224, St. Vincent, 114 fathoms. Station 232, St. Vincent, 88 fathoms. Station 233, St. Vincent, 174 fathoms. Station 239, Grenadines, 338 fathoms. Station 240, Grenadines, 164 fathoms. Station 241, Grenadines, 163 fathoms. Station 269, St. Vincent, 124 fathoms. Station 270, St. Vincent, 75 fathoms. Station 272, Barbados, 76 fathoms. Station 277, Barbados, 106 fathoms. Station 283, Barbados, 237 fathoms. Station 290, Barbados, 73 fathoms. Station 296, Barbados, 84 fathoms. Station 297, Barbados, 123 fathoms. Bartlett, Station 5, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 288 fathoms. Station 316, 32° 7′ N., 78° 37′ 30″ W., 229 fathoms.

Ophiocamax fasciculata sp. nov.

Plate VII. Figs. 92-94.

Special Marks. — Disk covered with thin, small, smooth scales, of which there are about ten radiating rows in each interbrachial space, and which are beset by scattered, short, thin spines. Radial shields smooth and regular, and joined their whole length.

Description of an Individual (Station 209). — Diameter of disk 15 mm. Width of arms close to disk 4.5 mm. About twenty-three long, smooth, crowded mouth-papillæ to each angle, arranged in two or three tiers. On the upper part of the jaw-plate are about seven very short, blunt teeth, and, below these, usually eight tooth-papillæ arranged in pairs. Often the teeth do not stand immediately one above the other, but partly alternate. Mouth-shields smooth and a little swollen, of a wide heart-shape with a slight lobe outward ; length to breadth, 2 : 2. Side mouth-shields wide and meeting fully within. Under arm-plates wide triangular, with a sharp angle within, rounded lateral corners, and wavy sides. They are considerably swollen near the middle. Side arm-plates stout, with a thick spine-ridge; they meet both above and below. Upper arm-plates much rounded triangular, with the outer margin swollen. Disk thick, flat on top and not constricted in the interbrachial spaces. It is covered with thin, smooth overlapping scales, of which there are ten or twelve radiating rows in each upper interbrachial space. Above, the disk is beset with short, slender, smooth, tapering spines. Radial shields flat and smooth, of a short pear-seed shape, and joined throughout. Length to breadth, 3 : 2. Six long flattened arm-spines bearing thorns on their two edges. The second is often as long as three arm-joints, the third nearly as long as two, and the fourth and fifth a little longer than one, while the uppermost and lowest are shortest of all. Three and sometimes four spine-like tentacle-scales to each pore, standing in a clump and turned inward. Color in alcohol, disk gray; arms pale yellowish.

A very fine specimen from Station 147 had a disk of 20 mm. and arms about 180 mm. long. There were usually but five spines, the uppermost short one being wanting, while the second was sometimes as long as five joints. The disk-scales were thicker than in the type, the basal tentacle-scales longer and more numerous, and the under arm-plates and spine-ridges more swollen. The disk-spines were few and scattered. *O. fasciculata* stands between *O. vitrea* and *O. hystrix;* but the former has nine arm-spines and the upper arm set with fine points, while the latter has eight arm-spines and much coarser disk-scales bearing coarse thorny stumps.

Station 145, St. Kitts, 270 fathoms. Station 147, St. Kitts, 250 fathoms. Station 148, St. Kitts, 208 fathoms. Station 209, Martinique, 189 fathoms. Station 295, Barbados, 180 fathoms.

Ophiocamax hystrix Lym.

Station 134, Santa Cruz, 248 fathoms. Station 148, St. Kitts, 208 fathoms. Station 157, Montserrat, 120 fathoms. Station 158, Montserrat, 148 fathoms. Station 209, Martinique, 189 fathoms. Station 224, St. Vincent, 114 fathoms. Station 233, St. Vincent, 174 fathoms. Station 238, Grenadines, 127 fathoms. Station 241, Grenadines, 163 fathoms. Station 269, St. Vincent, 124 fathoms. Station 274, Barbados, 209 fathoms. Station 280, Barbados, 221 fathoms. Station 291, Barbados, 200 fathoms. Bartlett, Station 5, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 228 fathoms. Bartlett, Station 29, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms.

Ophiothamnus vicarius Lym.

Station 100, off Morro Light, 250–400 fathoms. Station 175 (young), Dominica, 611 fathoms. Station 190, Dominica, 542 fathoms (young), sp.? Plate VI. Fig. 88. Station 204, Martinique, 476 fathoms. Station 315, 32° 18′ 20″ N., 78° 43′ W., 225 fathoms. Station 316, 32° 7′ N., 78° 37′ 30″ W., 229 fathoms.

OPHIOCOPA* gen. nov.

Disk covered with fine imbricated scales, which may bear grains; and small radial shields. Numerous close-set mouth-papillæ, with teeth but no tooth-papillæ. Side arm-plates nearly meeting above and below. Some of the arm-spines flattened and widened like an oar-blade. Two long genital openings in each interbrachial space.

Ophicopa spatula sp. nov.

Plate VII. Figs. 95-98.

Special Marks. — Five arm-spines, which, near base of arm, are flat and all more or less widened. Five papillæ on each side of a mouth-angle, whereof the outermost is widest. Granules on upper margin of disk.

Description of an Individual. — Diameter of disk 9 mm. Width of arm near disk 2 mm. Five crowded mouth-papillæ on either side of an angle, whereof the four innermost are small and narrow, while the outermost one is as wide as three of them. Four teeth, of which the upper and the under one are more or less pointed, while the other two are wide with a curved cutting edge. Mouth-shields of a wide diamond-shape with rounded angles; length to breadth, 1.5 : 1.5. Side mouth-shields long and tapering inward to a point; their outer end widened so as to embrace a corner of the mouth-shield. Under arm-plates much wider than long, of a broad shield-shape, with a wide curve without, re-entering curves on the sides, and a very obtuse angle within. Side arm-plates not prominent, nearly or quite meeting above and below. Upper arm-plates much wider than long, transverse diamond-shape with lateral angles sharp. Disk covered with smooth flat imbricated scales, the largest 1 mm. long; between the radial shields, in interbrachial space, there are four or five radiating rows. Along margin of disk is an irregular line of granules. Radial shields rounded, a little swollen, about as broad as long, closely joined; length to breadth, 1.5 : 1.5. Genital openings large and extending from mouth-shield to margin of disk. Five arm-spines, whereof the lowest is shortest, about as long as one arm-joint, and blunt and flattened; the two uppermost are also flattened, but sharp, and about as long as two joints; the two middle ones are, near base of arm, much flattened, and are widened at their tip like a spatula and microscopically serrated on their edges: farther out, they are simply wide and flat. Two oval, rather large tentacle-scales to each pore. Color in alcohol, gray.

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* ὄφις, snake; κώπη, oar.

"Challenger" Expedition, Station 219, 1° 50′ S., 146° 42′ E., 150 fathoms, mud. One specimen.

Ophiothrix Suensonii Ltk.

Station 127, Santa Cruz, 38 fathoms. Station 142, Flannegan Passage, 27 fathoms. Station 152, St. Kitts, 122 fathoms. Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 189, Dominica, 84–120 fathoms. Station 247, Grenada, 170 fathoms. Station 249, Grenada, 262 fathoms. Station 262, Grenada, 92 fathoms. Station 269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 276, Barbados, 94 fathoms. Station 277, Barbados, 106 fathoms. Station 285, Barbados, 13–40 fathoms. Station 286, Barbados, 7–45 fathoms. Station 290, Barbados, 73 fathoms. Station 292, Barbados, 56 fathoms. Station 293, Barbados, 82 fathoms. Station 294, Barbados, 137 fathoms. Station 298, Barbados, 120 fathoms.

Ophiothrix angulata Ayres.

Station 142, Flannegan Passage, 27 fathoms. Station 152, St. Kitts, 122 fathoms. Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 177, Dominica, 118 fathoms. Station 203, Martinique, 96 fathoms. Station 241, Grenadines, 163 fathoms. Station 246, Grenada, 154 fathoms. Station 247, Grenada, 170 fathoms. Station 249, Grenada, 262 fathoms. Station 285, Barbados, 13–40 fathoms. Station 292, Barbados, 56 fathoms. Bartlett, Station 30, 21° 26′ 30″ N., 86° 28′ 40″ W., 51 fathoms. Bartlett, entrance to Port Royal, Jamaica, 100 fathoms.

Ophioscolex tropicus Lym.

Station 195, Martinique, 502½ fathoms. Station 266, Grenada, 461 fathoms. Station 211, Martinique, 357 fathoms. Station 273, Barbados, 103 fathoms.

Young specimens resemble the young of *O. purpureus*, but have much more regular mouth-papillæ and flatter arm-spines.

Ophioscolex glacialis Müll. & Tr.

Station 336, 38° 21′ 50″ N., 73° 32′ W., 197 fathoms.

From the following three stations, lying much farther to the south, there were specimens having shorter and more numerous mouth-papillæ, and much thinner skin. I prefer to consider them as varieties, until additional specimens shall prove their final relations.

Station 185, Dominique, 333 fathoms (young). Station 274, Barbados, 209 fathoms (young). Station 293, Barbados, 82 fathoms (young).

OPHIOTOMA* gen. nov.

Disk covered by a thick, naked skin, which conceals the small shapeless radial shields. Numerous mouth-papillæ and teeth; no tooth-papillæ. Arm-spines hollow, as in Ophiacantha, and smooth. Upper arm-plates present. Two genital openings in each interbrachial space.

The genus may be called an Ophioscolex with upper arm-plates and hollow arm-spines.

Ophiotoma coriacea sp. nov.

Plate II. Figs. 1-3.

Special Marks. — A dozen spiniform or tooth-like papillæ to each mouth-angle, besides two minute ones under each of the second mouth-tentacles. Five smooth, slender, tapering arm-spines.

Description of an Individual. — Diameter of disk 16 mm. Width of arm near disk 3 mm. Mouth-angle elongated and bearing about a dozen papillæ, whereof the outer ones incline to be spiniform, while those within are somewhat more flattened and tooth-like. The second mouth-tentacle has also a couple of minute spiniform scales, which stand on the side mouth-shields. Seven or eight stout, flat spear-head-shaped teeth. Mouth-shields wide triangular with rounded corners; length to breadth, 2.5 : 1.5. Side mouth-shields narrow within and not quite meeting, while without they spread inward to the first under arm-plate, and upward round the corner of the mouth-shield to the head of the genital opening. Under arm-plates small, about as broad as long; shield-shaped with a feeble angle inward; length to breadth, 1.2 : 1.2. Side arm-plates flat with an ill-marked spine-crest at their outer margin; they meet below, but not above. Upper arm-plates wider than long, hexagonal with outer and inner angles rounded, and lateral angles sharp. Disk rather thick and covered by a tough skin, which exhibits obscurely below a fine scaling, and above a few very minute, scattered spines. Over each side of the arms is a swelling which looks like a radial shield, but is really the head of the large genital plate, the small radial shield being wholly hidden under the skin. Genital openings large, and extending from mouth-shield to margin of disk. Five slender, delicate, tapering, rounded hollow arm-spines. No tentacle-scales outside the mouth. Color in alcohol, disk greenish; arms pale brown.

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* ὄφις, snake; τομή, a cut.

Station 308, 41° 24′ 45″ N., 65° 35′ 30″ W., 1242 fathoms, 1 specimen.

Ophiosciasma granulatum sp. nov.

Plate VII. Figs. 99-102.

Special Marks. — Minute papillæ on edges of mouth-angles. Arms flat and rather wide. Two flat, translucent arm-spines with rough edges.

Description of an Individual. — Diameter of disk 6 mm. Arms very low and flat; width near disk 1.2 mm. Mouth-angles rather large, and bearing on their edges a row of minute saw-like papillæ; the two or three at the apex are somewhat larger. Mouth-shields small and rounded, with a slight angle inward; length to breadth, .7 : .7. Side mouth-shields wide and fully meeting within. Under arm-plates rather thick, longer than broad, wider without than within, and with deep re-entering curves on the sides, where are the tentacle-pores. Side arm-plates projecting in a strong spine-ridge, meeting neither above nor below. The upper surface, covered only by a thin skin, shows distinctly the tops of the elongated arm-bones with the pairs of circular muscle-fields between them. Farther out on the arm there appears a central depression, which towards the end penetrates quite through, until, at the tip, the bone appears as two long slender pieces curving towards each other, and uniting at either extremity. Disk covered with skin having scattered grains on its surface, which are opaque white. No scales or radial shields are visible. Two translucent rough arm-spines, a little longer than a joint, and standing at a strong angle to the arm. They are composed of two flattened spicules soldered together, each of which has two or three spurs on its free edge (Fig. 101), and are enclosed in a skin-bag. Tentacles simple, fleshy, and very thick. No tentacle-scales. Color in alcohol, pale yellowish, with yellow tentacles.

A larger specimen with a disk of 10 mm. had arms 45 mm. long; but did not differ except in having many of the disk granules buried in the thick skin.

Station 203, Martinique, 96 fathoms, 1 specimen. Bartlett, entrance to Port Royal, Jamaica, 100 fathoms, 1 specimen.

The species is readily distinguished from *O. attenuatum* by much wider arms, and by two instead of three arm-spines.

Ophiogeron supinus sp. nov.

Plate VII. Figs. 103-106.

Special Marks. — Arms very flat and covered with thick, loose skin. Two glassy, slender, smooth arm-spines enclosed in a common skin-bag.

Description of an Individual. — Diameter of disk 18 mm. Length of arm about 85 mm. Width of arm near disk 5 mm. Height of arm 2.5 mm. On either side of the large mouth-angle is an irregular row of minute, conical papillæ; a cluster of similar tooth-papillæ stands on the jaw-plate; and, above these, are small, spine-like teeth. Mouth-shields small, as broad as long, presenting an angle within and a curve without. Side mouth-shields long and pretty wide; fully meeting within; and, at their outer ends, extending much beyond the mouth-shield. At base of arm all plates are quite obscured by skin; but at the tip may be seen small under arm-plates, longer than broad, and pentagonal, with re-entering lateral sides and an angle within. The side arm-plates then meet below, but do not encroach on the upper surface. As there are no upper plates, the arm-bone may be seen, divided into its two embryonic halves. Disk uniformly covered by a soft, naked, wrinkled skin, which was much torn in the specimens observed. Genital openings long and large, extending from mouth-shield to margin of disk. Two glassy, smooth, slender arm-spines, longer than a joint, and enclosed in a common skin-bag. No tentacle-scales. Color in alcohol, pale brown.

Station 148, St. Kitts, 208 fathoms, 2 specimens. Station 291, Barbados, 200 fathoms. Station 230, St. Vincent, 464 fathoms (young).

The long flat arms covered by loose skin readily distinguish this species from *O. edentulus.*

There are, under the skin, just over the arms, small rounded radial shields, and, articulated to them, very short genital scales and plates, very much as in Ophiobyrsa. In the substance of the skin are imbedded fine scales, especially near the disk margin.

Ophiohelus umbella Lym.

Station 300, Barbados, 82 fathoms.

Ophiomyces mirabilis Lym.

Station 222, St. Lucia, 422 fathoms.

Ophiomyces frutectosus Lym.

Station 281, Barbados, 288 fathoms. Station 282, Barbados, 154 fathoms.

Ophiobyrsa Perrieri sp. nov.

Plate II. Figs. 4-6.

Special Marks. — Skin of disk naked, except clumps of short spines over the radial shields. No spines on upper side of arms.

Description of an Individual. — Diameter of disk 22 mm. Length of arm 270 mm. Width of arm close to disk 4 mm. The mouth-angles, which are covered with thick skin, have a few short spiniform papillæ at the apex, arranged chiefly on the jaw-plate. Mouth-shields and other plates about the mouth quite obscured by thick skin. Top of arm covered also by a very thick, tough skin, but destitute of anything like upper arm-plates, except a certain amount of thin lime-crust, underlying it. Under arm-plates swollen, rounded, about as long as broad, and broader without than within. They are obscured by the overlying skin. Side arm-plates like little flaps or pads inclining outward. Disk rounded and wrinkled, covered by a thick skin which is naked except over the radial shields where are clusters of very short, blunt spines. Six equal, short, blunt arm-spines, not as long as a joint; when stripped of the thick covering skin, they are rough and translucent. Tentacles large and simple. No tentacle-scales. Color in alcohol, light yellowish brown.

Bartlett, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 288 fathoms, 1 specimen.

Ophiobyrsa serpens sp. nov.

Plate VIII. Figs. 117-119.

Special Marks. — Three short, glassy, slightly thorny arm-spines covered by thick skin. Mouth-angle long and bearing a line of minute papillæ on either side.

Description of an Individual. — Diameter of disk 16 mm. Length of arm (from another specimen) above 140 mm. Width of arm near disk 2.8 mm. On either side of the inner part of each mouth-angle is a line of about five minute papillæ covered by thick skin. Five small, spine-like teeth, of which the uppermost are longest. A thick skin hides mouth-shields, side mouth-shields, and under arm-plates. Side arm-plates project like little flaps. Disk covered by a naked, wrinkled skin; along its margin runs a row of minute peg-like spines, of which there is also a radiating row over the place of each radial shield. Genital openings large and extending from the region of the mouth-shield to margin of disk. Three short, glassy, slightly thorny arm-spines, of which the lowest is longest and about as long as a joint; they are covered by skin. No tentacle-scales. Color in alcohol, above, umber variegated with yellowish brown; below, similar but lighter.

Station 278, 69 fathoms, 2 specimens.

O. serpens differs from *O. Perrieri* in having three arm-spines instead of five; and in longer mouth-angles with minute papillæ. The fact that it preserves its color in alcohol suggests that it lives also in shallow water, although now found for the first time in 69 fathoms.

Ophiobyrsa hystricis sp. nov.

Plate VIII. Figs. 120-122.

Special Marks. — At apex of mouth-angle two or three large, peg-like mouth-papillæ; and two or three others much smaller, on either side, arranged in a line which runs high up on the side of the angle. Five slim, glassy arm-spines covered with skin.

Description of an Individual.— Diameter of disk 20 mm. Length of arm 187 mm. Wdith of arm near disk 5.5 mm. Height of arm 3 mm. The somewhat long and narrow mouth-angle bears at its end a pair of stout, peg-like papillæ, and sometimes a third standing above them; on either side of the angle, considerably above its lower edge, is a line of three similar but much smaller papillæ. Mouth-shields and side mouth-shields entirely hidden by skin, as are the plates of the arm. On removing the skin, the under arm-plates are seen to be about 1 mm. long and squarish, with outer corners cut off. Side arm-plates like ridges, tapering at both ends, and with their lower end a little inserted between the under plates. There is nothing to represent upper arm-plates except two small nodules, one on each side of the median line. These are homologous with the double row of spine-bearing tubercles found in *O. rudis.* Disk thick and swollen, and covered by a tough skin; its upper surface is sparsely set with very short spines, more numerous and longer over the region of the radial shields, but all covered and obscured by the disk-skin. Genital openings large, and nearly extending to margin of disk. Five slender, slightly rough, glassy, nearly equal arm-spines, about as long as one and a half arm-joints. They are covered by thick skin. Very large fleshy tentacles, but no tentacle-scales. Color in alchol, pale straw, with yellow tentacles.

"Porcupine" Expedition, 1869, Station 65, northwest of Shetland Islands, 345 fathoms, water 1°.7 Cent.

This is the species mentioned by Sir Wyville Thomson on page 123 of the "Depths of the Sea." It comes from the "cold area," where the sea is at or below the freezing point of fresh water; whereas the three other species, *O. rudis*, *O. serpens,* and *O. Perrieri,* from Australia and the West Indies, inhabit much warmer water. By its small papillæ on the sides of the mouth-angles this species differs from the typical Ophiobyrsa and approaches Ophioscolex; the joints of the arm-bones are, however, essentially as in Ophiobyrsa.

Ophiomyxa tumida sp. nov.

Plate I. Figs. 1-3.

Special Marks. — Four or five slender, tapering, slightly rough arm-spines. Only a trace of upper arm-plates. Radial shields small and not bedded in a cluster of scales. A single marginal line of small plates round the disk.

Description of an Individual (21° 23′ 19″ N., 82° 54′ 42″ W.). — Diameter of disk 13 mm. Width of arm close to disk 3 mm. Length of arm 95 mm. Four flat, rounded papillæ with rough cutting edges on each side of the mouth-angles; and five or six teeth of similar form, but with nearly smooth edges. Mouth-shields showing indistinctly under the skin as transverse oval figures. On boiling the skin of the arm in potash there are found under arm-plates of a shield-shape, with a strong central notch and two angles on the outer side and a peak within; while the side arm-plates are seen as ridges nearly meeting below, where they are thickest, and have a notch in their outer side through which passes the tentacle. Only a trace of upper plates in form of little crusts of lime. Disk five-sided with re-entering curves; covered by a naked, loose, wrinkled skin, under which is found a continuous marginal line of small plates, which runs quite round the entire edge. Attached by their outer ends to this line of plates are small, short, club-shaped radial shields, which have no such cluster of small scales as are often found in the genus. Four or five slender, somewhat flattened, blunt, slightly rough arm-spines, about as long as a joint. No tentacle-scales. Color in alcohol, disk gray; arms straw.

Usually this genus has low side arm-plates, and a high arch of separate pieces which represent the upper arm-plates. The latter are nearly wanting in *O. tumida*, while the side arm-plates run somewhat farther upwards than common.

Two other lots from Stations 319, 32° 25′ N., 77° 42′ 30″ W., 262 fathoms, and 320, 32° 33′ 15″ N., 77° 30′ 10″ W., 257 fathoms, may be the young of this species. The specimens differed in having, with a disk of 9 mm., two, or at most three, arm-spines. The radial shields were as in *O. tumida*, but there was no well-marked marginal line of plates. There were, however, microscopic crust-like scales under the disk skin, which may also be detected in *O. tumida*. The specimens were fertile and were viviparous.

Station 132, Santa Cruz, 115 fathoms. Station 139, Santa Cruz, 218 fathoms. Station 146, St. Kitts, 245 fathoms. Station 147, St. Kitts, 250 fathoms. Station 148, St. Kitts, 208 fathoms. Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 158, Montserrat, 148 fathoms. Station 165, Guadeloupe, 277 fathoms. Station 172, Guadeloupe, 62–180 fathoms. Station 177, Dominica, 118 fathoms. Station 203, Martinique, 96 fathoms. Station 205, Martinique, 334 fathoms. Station 220, St. Lucia, 116 fathoms. Station 231, St. Vincent, 95 fathoms. Station 232, St. Vincent, 88 fathoms. Station 238, Grenadines, 127 fathoms. Station 241, Grenadines, 163 fathoms. Station 246, Grenada, 154 fathoms. Station 247, Grenada, 170 fathoms. Station 259, Grenada, 159 fathoms. Station 269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms. Station 281, Barbados, 288 fathoms. Station 285, Barbados, 13–40 fathoms. Station 290, Barbados, 73 fathoms. Station 291, Barbados, 200 fathoms. Station 296, Barbados, 84-125 fathoms. Bartlett, 21° 23′ 19″ N., 82° 54′ 42″ W., 300 fathoms. Santiago de Cuba, 288 fathoms. Station 319, 32° 25′ N., 77° 42′ 30″ W., 262 fathoms. Station 320, 32° 33′ 15″ N., 77° 30′ 10″ W., 257 fathoms.

Ophiomyxa serpentaria sp. nov.

Plate VIII. Figs. 114-116.

Special Marks. — Three short, tapering, blunt, translucent arm-spines enclosed in skin-bags. Three small mouth-papillæ on either side of the mouth-angle, near its apex. Under and side arm-plates soldered together. No upper arm-plates. Skin of disk without apparent scales and with only small radial shields.

Description of an Individual. — Diameter of disk 19 mm. Length of arm 50 mm. Width of arm near disk 3 mm. On either side of each mouth-angle, near its apex, are three mouth-papillæ, of the usual flattened form with saw-like edge. The innermost one is largest; the two outer ones are smaller, and more or less obscured by thick skin. Teeth similar to innermost mouth-papilla. Mouth-shields and side mouth-shields wholly hidden by thick skin. On removing the skin there are seen under arm-plates of elongated shape with deep re-entering curves on their sides where are the tentacle-pores; they are soldered together and with the side arm-plates, and have on their upper surface four knobs for attachment to the arm-bones. Side arm-plates thick and shapeless, extending to the upper surface of the arm. No upper arm-plates. Disk covered by a smooth tough skin, which under the microscope is seen to be full of little, rounded, thin scattered scales. There is no marginal row of plates; and the very small radial shields, which lie in the angle made by the arm with the disk, have no bed of scales. Genital openings running from mouth-shields rather more than half-way to margin of disk. Three arm-spines about 1.7 mm. long, widely spaced and standing at a large angle with the arm; their base is enclosed by thick skin, which being stripped off, they appear cylindrical tapering, blunt, and translucent; under the microscope they are slightly rough. Tentacles large and fleshy, but without scales. The articulating faces of the arm-bones do not approach the Astrophyton form so much as do those of other members of the genus, but come nearer the type of the true Ophiurans.

"Porcupine" Expedition, Station 54, between Færoë Islands and Hebrides, 363 fathoms, water 0°.3 Cent., 1 specimen.

The under arm-plates are shaped somewhat like those of *O. vivipara*, while the disk-skin, almost without lime-scales, reminds one of *O. australis*. The absence of upper arm-plates marks this new species as the Northern correspondent of the Antarctic *O. vivipara*, which is plentiful; and it is therefore singular that only one specimen of the Northern representative should thus far have been found.

Ophiochondrus crassispinus sp. nov.

Plate VII. Figs. 111-113.

Special Marks. — Seven or eight thick, short, blunt, slightly rough arm-spines. Radial shields long and prominent. Mouth-papillæ sharp and separated.

Description of an Individual. — Diameter of disk 6 mm. Length of arm 20 mm. Width of arm close to disk 2 mm. Three short, stout, sharp mouth-papillæ on each side of an angle, and one similar but larger at the apex; this last may be considered as the lowest tooth. Mouth-shields somewhat swollen, about as broad as long, with an angle inward. Side mouth-shields large, thick and wide; broader without than within where they meet. First under arm-plate small, longer than broad, with an angle inward. Those beyond are separated one from another, and are four-sided and much wider than long, with a slight re-entering curve without. Side arm-plates with narrow, prominent spine-ridges; meeting below but separated above by fan-shaped upper arm-plates which present a truncated angle inward. Disk thick, sparsely beset with a fine granulation, except on the radial shields which are prominent and large; they are much longer than broad, wider without than within, and separated; their ends are rounded; length to breadth, 2 : .6. Seven or eight short, blunt, slightly rough arm-spines, which stand at a considerable angle to the arm; they are nearly equal and not so long as a joint; those in the middle often are swollen at their base. No tentacle-scales. Color in alcohol, pale straw.

Station 316, 32° 7′ N., 78° 37′ 30″ W., 229 fathoms, 1 specimen.

This species is well distinguished from *O. stelliger* by its great naked radial shields and numerous arm-spines; and from *O. convolutus* by different mouth-papillæ and no tentacle-scale.

Ophiochondrus squamosus.

Plate VII. Figs. 108-110.

Special Marks. — Disk covered above by thick, lumpy, separated plates, and below by lumpy scales. Seven or eight short conical arm-spines. Lower arm-plates obscured by thick skin.

Description of an Individual. — Diameter of disk 6.5 mm. Length of arm 40 mm. Width of arm near disk without spines 1.3 mm. Three small, somewhat flattened, separated papillæ on each side of a mouth-angle, whose apex is occupied by the lowest tooth, which is large and of a wide spear-head shape. Mouth-shields small, of a transverse oval form; length to breadth, .5 : .6. Side mouth-shields scarcely visible under the thick skin; they are narrow and meet within. Basal under arm-plates obscured by thick skin; farther out on arm, they appear as thick, widely separated transverse oval plates, and near the end they are squarish and nearly or quite touch each other. Side arm-plates projecting as narrow spine-crests, and meeting neither above nor below. Upper arm-plates much wider than long, transverse oval, thick and microscopically tuberculated; length to breadth, .5 : .9. Disk rather thick and covered above by high, lumpy, irregular, microscopically tuberculous plates, which are widely separated by depressed lines. Interbrachial spaces below covered by lumpy scales. Radial shields pear-seed-shape, small, and separated by a single row of plates; length to breadth, 1 : .5. Seven or eight (sometimes only six) short, stout, conical, equal arm-spines, about as long as a joint. Two minute, rounded tentacle-scales. Color in alcohol, nearly white; tentacles brownish.

Station 147, St. Kitts, 250 fathoms, 1 specimen.

At first sight this species seems like a new genus, owing to its peculiar disk covering; but I do not doubt it belongs under Ophiochondrus, although I have had no chance to examine the arm-bones.

Ophiochondrus convolutus Lym.

Station 100, off Morro Light, 250–400 fathoms. Station 208, Martinique, 213 fathoms. Station 219, St. Lucia, 151 fathoms. Station 224, St. Vincent, 114 fathoms. Station 232, St. Vincent, 88 fathoms. Station 233, St. Vincent, 174 fathoms. Station 238, Grenadines, 127 fathoms. Station 253, Grenada, 92 fathoms. Station 254, Grenada, 164 fathoms. Station 269, St. Vincent, 124 fathoms. Station 280, Barbados, 221 fathoms.

Hemieuryale tuberculosa sp. nov.

Plate VIII. Figs. 123-127.

Special Marks. — Upper arm-plate persistent to base of arm and there surrounded by large grains or tubercles. Two short flattened arm-spines which grow larger towards their ends.

Description of an Individual (Station 203). — Diameter of disk 6.5 mm. Length of arm 37 mm. Width of arm near disk 2 mm. Three or four small, close-set, bead-like papillæ on each side of a mouth-angle, and just above its apex appears the lowest of the short, thick rounded teeth. Mouth-shields small and five-sided, with rounded corners and an angle inward; length to breadth, 1 : 1. Side mouth-shields ovoid and swollen, nearly as large as mouth-shields, and like them microscopically tuberculous. Under arm-plates swollen and soldered with surrounding parts, so that their outlines are indistinct; small, rounded, and separated from one another. Side plates a little swollen, meeting below, but rising only about half-way up the side of the arm. At its tip however they meet broadly above, where there is a small bead-like upper arm-plate. A few joints farther in, it becomes larger and has a supplementary piece at either corner, and a granule inside it, in the centre, and separating the side arm-plates (Fig. 127). Still farther in, the upper arm-plates have a transverse oval shape, and are separated by a group of five tubercles arranged in two rows, while the supplementary corner piece has become as large as the plate (Fig. 126). At the base of the arm the same arrangement prevails; but the upper plate is proportionately smaller and less regular, while the intermediate tubercles, from three to five in number, are conspicuous (Fig. 125). Disk small, and strongly contracted in the interbrachial spaces. It is covered by large radial shields which are much longer than wide and microscopically tuberculous; length to breadth, 2.2 : 1. In the centre of the disk is a five-sided space covered by closely soldered plates and tubercles, from which radiate five brachial and five interbrachial narrow spaces; the latter covered by plates, the former by plates bearing large tubercles. Lower interbrachial spaces covered by small, swollen, closely soldered plates. Two short, stout, flattened arm-spines not more than half as long as a joint, and growing wider at the end. At tip of arm there is but one spine. One round tentacle-scale. Color in alcohol, above variegated with shades of yellowish brown and with some of the tubercles white; below lighter with a broad longitudinal arm-band of purplish.

Station 132, Santa Cruz, 115 fathoms. Station 203, Martinique, 96 fathoms.

This species, with the top of its arm covered by polished beads of various colors, presents a curious aspect. It is readily distinguished from *H. pustulata* by the persistence of the upper arm-plate; and by having tubercles, instead of of a smooth mosaic, on the upper side of the arm.

Hemieuryale pustulata Lym.

Station 132, Santa Cruz, 115 fathoms. Station 203, Martinique, 96 fathoms. Station 276, Barbados, 94 fathoms. Station 277, Barbados, 106 fathoms. Station 296, Barbados, 94 fathoms.

Sigsbeia murrhina Lym.

Station 132, Santa Cruz, 115 fathoms. Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 166, Guadeloupe, 150 fathoms. Station 203, Martinique, 96 fathoms. Station 209, Martinique, 189 fathoms. Station 210, Martinique, 191 fathoms. Station 211, Martinique, 357 fathoms. Station 219, St. Lucia, 151 fathoms. Station 220, St. Lucia, 116 fathoms. Station 222, St. Lucia, 422 fathoms. Station 224, St. Vincent, 114 fathoms. Station 232, St. Vincent, 88 fathoms. Station 233, St. Vincent, 174 fathoms. Station 238, Grenadines, 127 fathoms. Station 241, Grenadines, 163 fathoms. Station 247, Grenada, 170 fathoms. Station 249, Grenada, 262 fathoms. Station 269, St. Vincent, 124 fathoms. Station 277, Barbados, 106 fathoms.

OPHIOBRACHION gen. nov.*

Entire animal clothed in a thick skin which hides the underlying plates and is beset on the disk with spines. Arms long, slender and serpentine. Upper arm-plates wanting. Side arm-plates forming a low ridge with a line of little mamelons each bearing a hooklet which answers to an arm-spine. Tentacles large and simple. Mouth-angles rounded, covered with thick skin and bearing at their apex a clump of spiniform papillæ. Two large genital openings in each interbrachial space.

The presence of hooklets, which replace the arm-spines *quite to the base of the arm*, is a feature found in no other Ophiuran; and, indeed, in none of the Astrophytons; for the hooklets of these, when found at the base of the arm, are not homologous with arm-spines, because they do not stand on the side arm-plate. At the tip of the Astrophyton arm there are, however, strictly homologous spines, like compound hooks, but these, as they approach the base of the arm, change gradually to short thick spines, or tentacle-scales, as they may also be called. (See Bull. M. C. Z., VI. 2, Plate XIX. Figs. 493–495.) As might be expected, the joints between the arm-bones are on the modified hour-glass pattern, similar to that found in Sigsbeia, and therefore approaching the corresponding structure among Astrophytons. In a word, this new genus belongs with such genera as Ophiomyxa and Ophiobyrsa, and stands nearest the simple-armed Astrophytons.

Ophiobrachion uncinatus sp. nov.

Plate VIII. Figs. 128-131.

Special Marks. — Arms six or seven times the diameter of disk. Seven or eight compound hooklets mounted on little cylindrical bases which rise from the side arm-plates.

Description of an Individual. — Diameter of disk 43 mm. Length of arm 270 mm. Width of arm close to disk 5 mm. Mouth-angle covered with thick skin and bearing at the apex an irregular clump of short, sharp spines, like prickles. All the mouth-shields obscured by thick skin, except the madreporic, whose transverse oval outline may be distinguished. It has a few irregular pores near its outer margin. Under arm-plates obscured by a thick skin, on removing which they are found to be of a rounded quadrangular form, wider without than within, swollen, and sometimes so cut out on the lateral sides, where the tentacles pass through, as to assume an axe-shape. They are continued upward by shapeless, rounded side arm-plates, which appear externally as well-marked spine-ridges, bearing a row of seven or eight small cylindrical knobs, each with a hole in its top to which is articulated a hooklet. The lowest knob is opposite the tentacle. No upper arm-plates; there are, however, two little lime nodules bedded in the skin of that region, over each joint. Disk large and flat, covered by a thick, somewhat wrinkled skin, densely beset above and below by short spines, whose bases are enclosed in a sheath of skin, beyond which projects a sharp, translucent point, or a fork. The arm-spines are represented by a row of seven or eight minute compound hooklets, about 1 mm. long. They are translucent and end in a sharp hook, and have two or three curved spurs on the same side. At the very tip of the arm the structure does not vary, except that the hooklets with their knob-like bases are reduced to two. The large smooth tentacles have no special scales. Color in alcohol, disk light yellowish brown; arms paler.

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* ὄφις, snake; βραχίων, arm.

Bartlett, south side of Cuba, 19° 48′ 47″ N., 77° 23″ W., 250 fathoms, 1 specimen.

Astrophyton cœcilia Ltk.

Station 269, St. Vincent, 124 fathoms. Station 290, Barbados, 73 fathoms. Station 296, Barbados, 84 fathoms.

Gorgonocephalus mucronatus Lym.

Bartlett, Station 5, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 288 fathoms. Station 139, Santa Cruz, 218 fathoms, var. ? Station 269, St. Vincent, 124 fathoms, var. ?

Astrocnida isidis Lym.

Station 156, Montserrat, 88 fathoms. Station 290, Barbados, 73 fathoms. Station 292, Barbados, 56 fathoms. Station 296, Barbados, 84 fathoms. Station 298, Barbados, 120 fathoms.

Astrogomphus vallatus Lym.

Station 209, Martinique, 189 fathoms. Station 224, St. Vincent, 114 fathoms. Station 232, St. Vincent, 88 fathoms. Station 269, St. Vincent, 124 fathoms. Station 318, 31° 48′ 50″ N., 77° 51′ 50″ W., 337 fathoms.

Astroporpa annulata Örst. & Ltk.

Station 132, Santa Cruz, 115 fathoms. Station 155, Montserrat, 88 fathoms. Station 178, Dominica, 130 fathoms. Station 203, Martinique, 96 fathoms. Station 241, Grenadines, 163 fathoms. Station 253, Grenada, 92 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 276, Barbados, 94 fathoms. Station 277, Barbados, 106 fathoms. Station 290, Barbados, 73 fathoms. Station 292, Barbados, 56 fathoms. Station 296, Barbados, 84 fathoms. Station 297, Barbados, 123 fathoms. Station 298, Barbados, 120 fathoms. Bartlett, Station 20, off entrance to Port Royal, Jamaica, 50 fathoms.

Astrochele Lymani Vll.

Station 307, 41° 29′ 45″ N., 65° 47′ 10″ W., 980 fathoms. Station 309, 40° 11′ 40″ N., 68° 22′ W., 304 fathoms.

Astroschema arenosum Lym.

Station 124, Santa Cruz, 580 fathoms. Station 131, Santa Cruz, 580 fathoms. Station 157, Montserrat, 120 fathoms. Station 159, Guadeloupe, 196 fathoms. Station 173, Guadeloupe, 734 fathoms. Station 227, St. Vincent, 573 fathoms. Station 269, St. Vincent, 124 fathoms. Station 281, Barbados, 288 fathoms.

Astroschema læve Lym.

Station 134, Santa Cruz, 248 fathoms. Station 156, Montserrat, 88 fathoms. Station 157, Montserrat, 120 fathoms. Station 203, Martinique, 96 fathoms. Station 216, St. Lucia, 154 fathoms. Station 218, St. Lucia, 164 fathoms. Station 219, St. Lucia, 151 fathoms. Station 224 St. Vincent, 114 fathoms. Station 231, St. Vincent, 95 fathoms. Station 249, Grenada, 262 fathoms. Station 272, Barbados, 76 fathoms. Station 273, Barbados, 103 fathoms. Station 276, Barbados, 94 fathoms. Station 290, Barbados, 73 fathoms. Station 292, Barbados, 56 fathoms. Station 296, Barbados, 84 fathoms.

Astroschema oligactes Ltk.

Station 156, Montserrat, 88 fathoms. Station 164, Guadeloupe, 150 fathoms. Station 220, St. Lucia, 116 fathoms. Station 224, St. Vincent, 114 fathoms. Station 241, Grenadines, 163 fathoms. Station 249, Grenada, 262 fathoms. Station 253, Grenada, 92 fathoms. Station 269, St. Vincent, 124 fathoms. Station 272, Barbados, 76 fathoms. Station 276, Barbados, 94 fathoms. Station 278, Barbados, 69 fathoms. Station 290, Barbados, 73 fathoms. Station 296, Barbados, 84 fathoms. Station 297, Barbados, 123 fathoms. Station 298, Barbados, 120 fathoms. Bartlett, entrance to Port Royal, Jamaica, 100 fathoms. Bartlett, Station 5, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 288 fathoms.

Astroschema tenue Lym.

Station 155, Montserrat, 88 fathoms. Station 156, Montserrat, 88 fathoms. Station 269, St. Vincent, 124 fathoms. Station 276, Barbados, 94 fathoms.

Astroschema brachiatum Lym.

Bartlett, Station 5, 3.3 m. S. E. by E. ½ E. from Santiago de Cuba Light, 288 fathoms.

Ophiocreas spinulosus sp. nov.

Plate VIII. Figs. 132-135.

Special Marks. — Radial shields beset with short, blunt spines, which are continued along the upper side of the arms.

Description of an Individual (Station 269). — Diameter of disk 8 mm. Length of arm 60 mm. Width of arm, 10 mm. from disk, 2.5 mm. Height of arm at same point 3 mm. Mouth-angles well separated from each other and bearing on the upper part of their sides a number of grains which have somewhat the look of mouth-papillæ. Seven short, wide flat teeth, with a rounded cutting edge; below them is an imperfect tooth, or a couple of papillæ. Arms higher than wide, and widest above. The covering skin is smooth and rather loose, and the joints are scarcely indicated. The upper surface bears short blunt spines, a pair to each joint; but these are not found beyond the base of the arm. The first pore beyond the mouth-slit has no tentacle-scale; the second, one; and the next, two, which are cylindrical, blunt, and somewhat tapering, the lower one being about 2 mm. long, and the upper one shorter. Farther out on the arm they become more slender, and at the extreme tip take on the form of minute double hooks. Disk high and angular with interbrachial spaces re-enteringly curved. Radial shields elevated as strongly marked ridges running to the centre and thickly set with short stout blunt spines. Genital openings large and wide, reaching nearly to the roof of the disk. Color in alcohol, pale pink.

The above-described specimen was not fully grown. A large one, with a disk of 13 mm. and arms 385 mm. long, differed only in having the spines more or less obliterated on the radial shields, but much more numerous on the tops of the arms. The arm-spines, also, were comparatively shorter and stouter.

Like *Ophiocamax fasculata*, *Ophiomusium Lymani*, and many other species, *Ophiocreas spinulosus* lives in great colonies. The tangles often came so clogged with hundreds of specimens that it was necessary to cut them off and throw the mass into alcohol. Mr. Agassiz reports the color of the living animal as brick red. A young specimen with a disk of 3 mm. had no spines on the disk or arms. Spines begin to appear only when the disk has reached 4 or 5 mm.

Station 208, Martinique, 213 fathoms. Station 216, St. Lucia, 154 fathoms. Station 233, St Vincent, 174 fathoms. Station 269, St. Vincent, 124 fathoms. Station 279, Barbados, 118 fathoms. Station 281, Barbados, 288 fathoms.

Ophiocreas lumbricus Lym.

Station 131, Santa Cruz, 580 fathoms. Station 171, Guadeloupe, 183 fathoms. Station 216, St. Lucia, 154 fathoms. Station 219, St. Lucia, 151 fathoms. Station 238, Grenadines, 127 fathoms. Station 263, Grenada, 159 fathoms. Station 281, Barbados, 288 fathoms.

Ophiocreas œdipus? Lym.

Station 124, Santa Cruz, 580 fathoms. Station 131, Santa Cruz, 580 fathoms.

The originals dredged by the "Challenger" at Station 344, off Ascension Island, in 420 fathoms, differed from these only in lacking all granulation on the mouth-angle. I suppose they are of the same species.

Astronyx Loveni Müll. & Tr. (Young.)

Plate VIII. Figs. 136-138.

Station 227, St. Vincent, 573 fathoms. Station 307, 41° 29′ 45″ N., 65° 47′ 10″ W., 980 fathoms. Station 338, 38° 18′ 40″ N., 73° 18′ 10″ W., 922 fathoms.

Cambridge, May, 1883.

DESCRIPTION OF PLATES.

PLATE I.

Fig. 1. *Ophiomyxa tumida*, from below; $\frac{5}{1}$.
Fig. 2. “ “ from above; $\frac{5}{1}$.
Fig. 3. “ “ arm-joints, profile; $\frac{5}{1}$.

PLATE II.

Fig. 1. *Ophiotoma coriacea*, from below; $\frac{4}{1}$.
Fig. 2. “ “ from above; $\frac{4}{1}$.
Fig. 3. “ “ arm-joints, profile; $\frac{4}{1}$.
Fig. 4. *Ophiobyrsa Perrieri*, from below; $\frac{4}{1}$.
Fig. 5. “ “ from above; $\frac{4}{1}$.
Fig. 6. “ “ arm-joints, profile; $\frac{4}{1}$.

PLATE III.

Fig. 1. *Pectinura tessellata*, from below; $\frac{3}{2}$.
Fig. 2. “ “ from above; $\frac{3}{2}$.
Fig. 3. “ “ arm-joints, profile; $\frac{3}{2}$.
Fig. 4. “ *lacertosa*, from below, $\frac{1}{1}$.
Fig. 5. “ “ from above; $\frac{1}{1}$.
Fig. 6. “ “ arm-joints, profile; $\frac{1}{1}$.
Fig. 7. “ *angulata*, from below; $\frac{3}{2}$.
Fig. 8. “ “ from above; $\frac{3}{2}$.
Fig. 9. “ “ arm-joints, profile; $\frac{3}{2}$.
Fig. 10. *Ophiozona marmorea*, from below; $\frac{4}{1}$.
Fig. 11. “ “ from above; $\frac{4}{1}$.
Fig. 12. “ “ arm-joints, profile; $\frac{4}{1}$.
Fig. 13. “ *clypeata*, from below; $\frac{7}{2}$.
Fig. 14. “ “ from above; $\frac{7}{2}$.
Fig. 15. “ “ arm-joints, profile; $\frac{7}{2}$.
Fig. 16. *Ophiochytra tenuis*, from below; $\frac{5}{1}$.
Fig. 17. “ “ from above; $\frac{5}{1}$.
Fig. 18. “ “ arm-joints, profile; $\frac{5}{1}$.

Fig. 19. *Ophiernus adspersus,* from below; $\frac{5}{2}$.
Fig. 20. “ “ from above; $\frac{5}{2}$.
Fig. 21. “ “ arm-joints, profile; $\frac{5}{2}$.
Fig. 22. *Ophioglypha fasciculata,* from below; $\frac{3}{1}$.
Fig. 23. “ “ from above; $\frac{3}{1}$.
Fig. 24. “ “ arm-joints, profile; $\frac{3}{1}$.
Fig. 25. “ *abyssorum,* from below; $\frac{3}{1}$.
Fig. 26. “ “ from above : $\frac{3}{1}$.
Fig. 27. “ “ arm-joints, profile; $\frac{3}{1}$.

PLATE IV.

Fig. 28. *Ophioglypha scutata,* from below; $\frac{11}{2}$.
Fig. 29. “ “ from above; $\frac{11}{2}$.
Fig. 30. “ “ arm-joints, profile; $\frac{11}{2}$.
Fig. 31. “ *tenera,* from below; $\frac{13}{2}$.
Fig. 32. “ “ from above; $\frac{13}{2}$.
Fig. 33. “ “ arm-joints, profile; $\frac{13}{2}$.
Fig. 34. “ *aurantiaca,* from below; $\frac{4}{1}$.
Fig. 35. “ “ from above; $\frac{4}{1}$.
Fig. 36. “ “ arm-joints; $\frac{4}{1}$.
Fig. 37. “ *falcifera* (adult), from below; $\frac{5}{2}$.
Fig. 38. “ “ from above; $\frac{5}{2}$.
Fig. 39. “ “ arm-joints, profile, showing the hooked spines; $\frac{5}{1}$.
Fig. 40. “ *convexa,* var. (Station 146), from below; $\frac{7}{2}$.
Fig. 41. “ “ from above; $\frac{7}{2}$.
Fig. 42. “ “ arm-joints, profile; $\frac{7}{2}$.
Fig. 43. “ “ (Station 206), from below; $\frac{7}{2}$.
Fig. 44. “ “ from above; $\frac{7}{2}$.
Fig. 45. “ “ arm-joints, profile; $\frac{7}{2}$.
Fig. 46. *Ophiocten Pattersoni,* from below; $\frac{7}{2}$.
Fig. 47. “ “ from above; $\frac{7}{2}$.
Fig. 48. “ “ arm-joints, profile; $\frac{7}{2}$.
Fig. 49. *Ophiomastus texturatus,* from below; $\frac{6}{1}$.
Fig. 50. “ “ from above; $\frac{6}{1}$.
Fig. 51. “ “ arm-joints, profile; $\frac{6}{1}$.
Fig. 52. *Ophiophyllum petilum ?* from below; $\frac{9}{2}$.
Fig. 53. “ “ from above; $\frac{9}{2}$.
Fig. 54. “ “ arm-joints, profile; $\frac{9}{2}$.

PLATE V.

Fig. 55. *Ophiomusium Lymani* (young), from below; $\frac{13}{2}$.
Fig. 56. “ “ from above; $\frac{13}{2}$.
Fig. 57. “ “ arm-joints, profile; $\frac{13}{2}$.

Fig. 58. *Amphiura incisa,* from below; $\frac{9}{2}$.
Fig. 59. “ “ from above; $\frac{9}{2}$.
Fig. 60. “ “ arm-joints, profile; $\frac{9}{2}$.
Fig. 61. “ *nereis,* from below; $\frac{15}{2}$.
Fig. 62. “ “ from above; $\frac{15}{2}$.
Fig. 63. “ “ arm-joints, profile; $\frac{15}{2}$.
Fig. 64. “ sp. nov.? (Station 220), from below; $\frac{9}{2}$.
Fig. 65. “ “ from above; $\frac{9}{2}$.
Fig. 66. “ “ arm-joints, profile; $\frac{9}{2}$.
Fig. 67. *Ophiochiton tenuispinus,* from below; $\frac{3}{1}$.
Fig. 68. “ “ from above; $\frac{3}{1}$.
Fig. 69. “ “ arm-joints, profile; $\frac{3}{1}$.
Fig. 70. *Ophiacantha Bairdi* from below; $\frac{7}{2}$.
Fig. 71. “ “ from above; $\frac{7}{2}$.
Fig. 72. “ “ arm-joints, profile; $\frac{7}{2}$.
Fig. 73. “ *Bartletti,* from below; $\frac{5}{2}$.
Fig. 74. “ “ from above; $\frac{5}{2}$.
Fig. 75. “ “ arm-joints, profile; $\frac{5}{2}$.
Fig. 76. “ *cervicornis,* from below; $\frac{3}{1}$.
Fig. 77. “ “ from above; $\frac{3}{1}$.
Fig. 78. “ “ arm-joints, profile; $\frac{3}{1}$.

PLATE VI.

Fig. 79. *Ophiacantha lineolata,* from below; $\frac{2}{1}$.
Fig. 80. “ “ from above; $\frac{2}{1}$.
Fig. 81. “ “ arm-joints, profile; $\frac{2}{1}$.
Fig. 82. “ *lævipellis,* from below; $\frac{15}{2}$.
Fig. 83. “ “ whole disk from above, to show the varied covering; $\frac{15}{2}$.
Fig. 84. “ “ arm-joints, profile; $\frac{15}{2}$.
Fig. 85. “ *scolopendrica,* from below; $\frac{5}{2}$.
Fig. 86. “ “ from above; $\frac{5}{2}$.
Fig. 87. “ “ arm-joints, profile; $\frac{5}{2}$.
Fig. 88. *Ophiothamnus vicarius?* (young), Station 190, 542 fathoms; $\frac{25}{1}$. The entire back of the disk is shown, beset with shafts, each bearing a bunch of three or more sharp, slender thorns. These show the embryonic form of the thorny stumps so common in Ophiacantha and allied genera. Only two joints of the short arms are represented.
Fig. 89. *Ophiomitra incisa,* from below; $\frac{5}{2}$.
Fig. 90. “ “ arm-joints, profile; $\frac{5}{2}$.

PLATE VII.

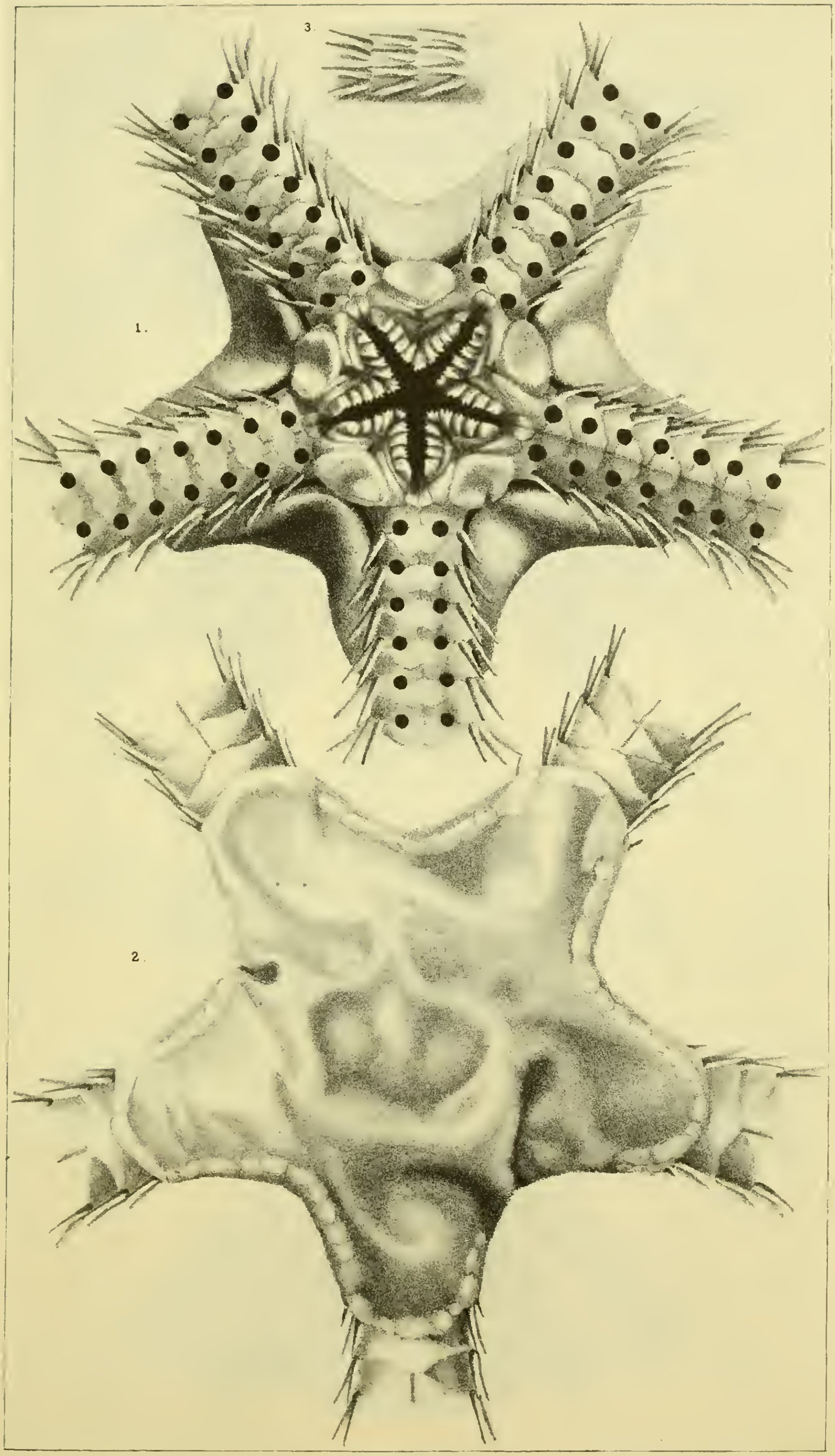
Fig. 91. *Ophiomitra incisa*, from above ; $\frac{5}{2}$.
Fig. 92. *Ophiocamax fasciculata*, from below ; $\frac{2}{1}$.
Fig. 93. " " from above ; $\frac{2}{1}$.
Fig. 94. " " arm-joints, profile ; $\frac{2}{1}$.
Fig. 95. *Ophiocopa spatula*, from below ; $\frac{4}{1}$.
Fig. 96. " " from above ; $\frac{4}{1}$.
Fig. 97. " " arm-joints, profile ; $\frac{4}{1}$.
Fig. 98. " " one of the flattened arm-spines ; $\frac{10}{1}$.
Fig. 99. *Ophiosciasma granulatum*, from below ; $\frac{5}{1}$.
Fig. 100. " " from above ; $\frac{5}{1}$.
Fig. 101. " " a flattened arm-spine in its skin-bag ; $\frac{45}{2}$.
Fig. 102. " " arm-joints ; $\frac{5}{1}$.
Fig. 103. *Ophiogeron supinus*, from below ; $\frac{3}{2}$.
Fig. 104. " " from above ; $\frac{3}{2}$.
Fig. 105. " " joints at tip of arm, from below ; $\frac{5}{1}$.
Fig. 106. " " joints at tip of arm from above showing absence of upper arm-plates, and division of arm-bones into halves ; $\frac{5}{1}$.
Fig. 107. " " joints at tip of arm, profile ; $\frac{5}{1}$.
Fig. 108. *Ophiochondrus squamosus*, from below ; $\frac{6}{1}$.
Fig. 109. " " from above ; $\frac{6}{1}$.
Fig. 110. " " arm-joints, profile ; $\frac{6}{1}$.
Fig. 111. " *crassispinus*, from below ; $\frac{7}{1}$.
Fig. 112. " " from above ; $\frac{7}{1}$.
Fig. 113. " " arm-joints, profile ; $\frac{7}{1}$.

PLATE VIII.

Fig. 114. *Ophiomyxa serpentaria*, from below ; $\frac{2}{1}$.
Fig. 115. " " from above ; $\frac{2}{1}$.
Fig. 116. " " arm-joints, profile : $\frac{2}{1}$.
Fig. 117. *Ophiobyrsa serpens*, from below ; $\frac{2}{1}$.
Fig. 118. " " from above ; $\frac{2}{1}$.
Fig. 119. " " arm-joints, profile ; $\frac{2}{1}$.
Fig. 120. " *hystricis*, from below, showing the large tentacles ; $\frac{2}{1}$.
Fig. 121. " " from above ; $\frac{2}{1}$.
Fig. 122. " " arm-joints, profile ; $\frac{2}{1}$.
Fig. 123. *Hemieuryale tuberculosa*, from below ; $\frac{7}{2}$.
Fig. 124. " " from above ; $\frac{7}{2}$.
Fig. 125. " " base of arm, profile ; $\frac{7}{2}$.
Fig. 126. " " joints from middle of arm, from above ; $\frac{7}{2}$.
Fig. 127. " " joints near tip of arm, profile ; $\frac{7}{2}$.

Fig. 128. *Ophiobrachion uncinatus*, from below; $\frac{1}{1}$.
Fig. 129. " " from above; $\frac{1}{1}$.
Fig. 130. " " arm-joints, profile. The arm-hooks have all fallen, leaving their little mamelons; $\frac{1}{1}$.
Fig. 131. " " an arm-hook; $\frac{8}{1}$.
Fig. 132. *Ophiocreas spinulosus*, from below; $\frac{3}{1}$.
Fig. 133. " " from above; $\frac{3}{1}$.
Fig. 134. " " joints near base of arm, profile; $\frac{3}{1}$.
Fig. 135. " " joints near tip of arm, profile; $\frac{3}{1}$.
Fig. 136. *Astronyx Loveni* (young), from below; $\frac{11}{2}$.
Fig. 137. " " from above; $\frac{11}{2}$.
Fig. 138. " " arm-joints, profile; $\frac{11}{2}$.

Pl. I.



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PL. II

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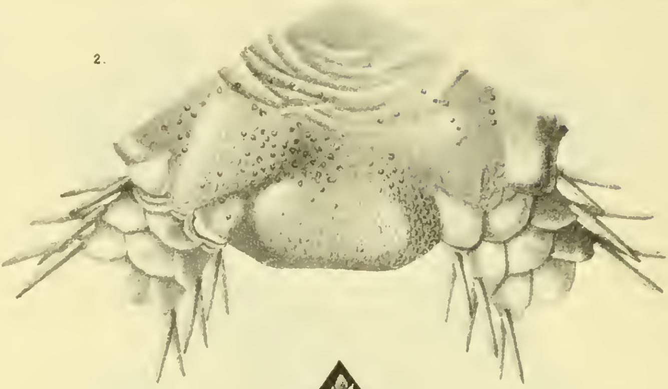

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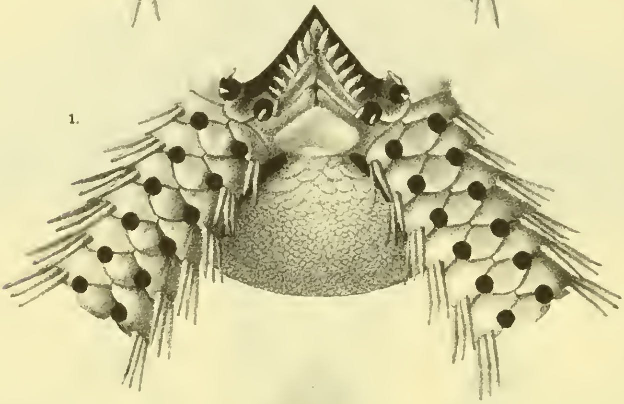

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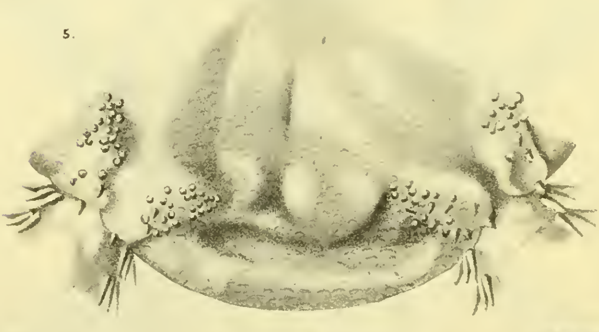

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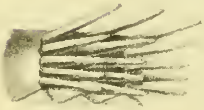

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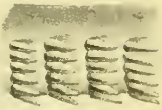

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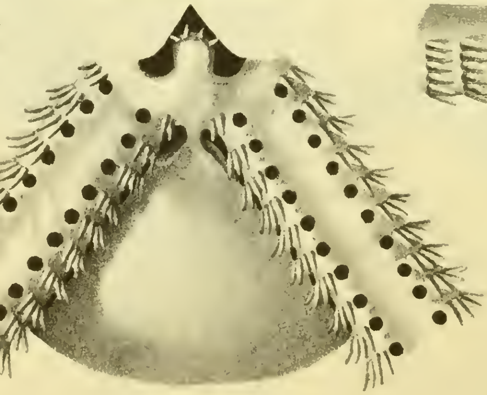

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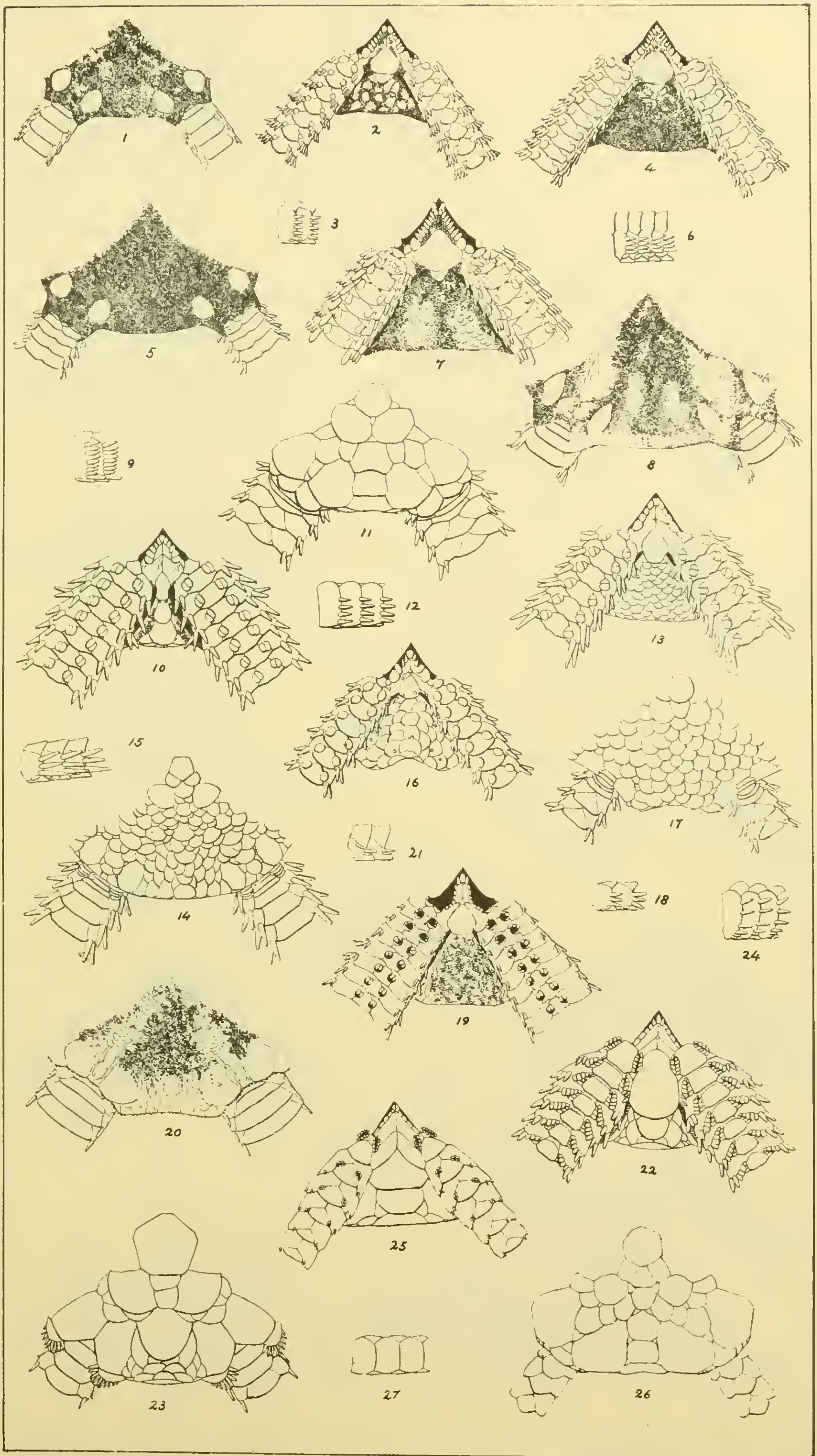
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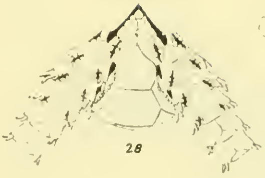
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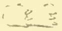
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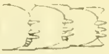
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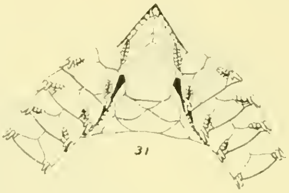
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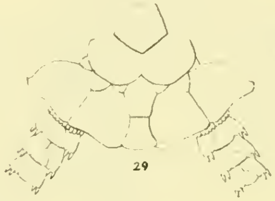
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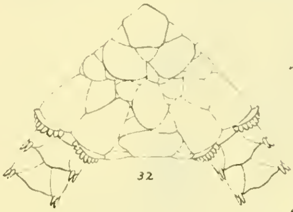
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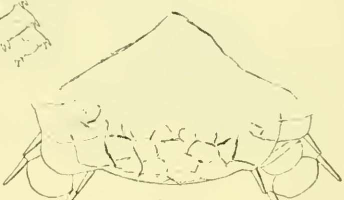
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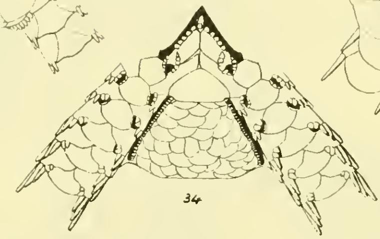
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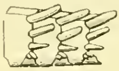
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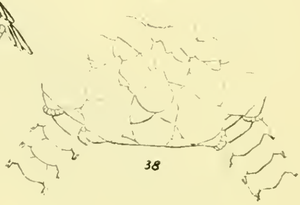
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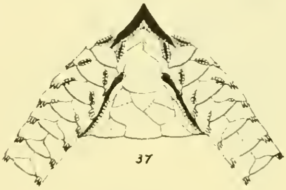
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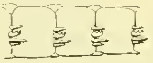
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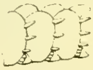
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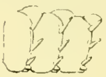
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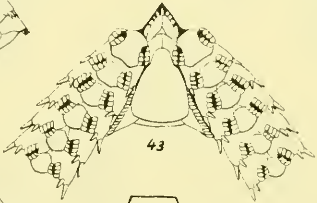
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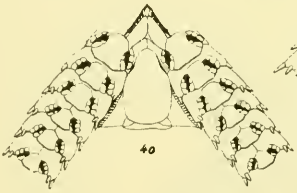
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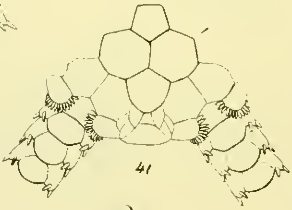
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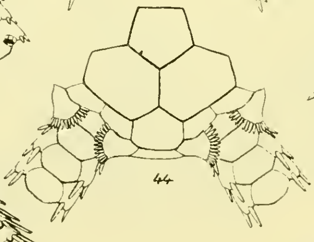
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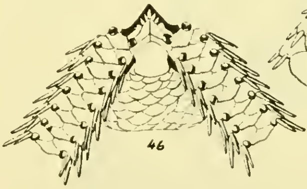
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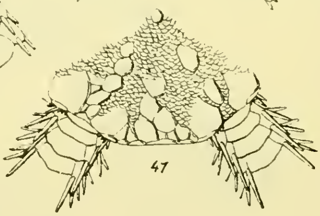
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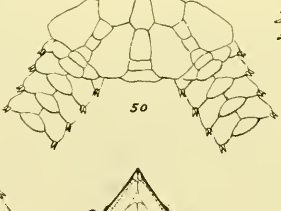
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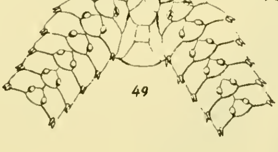
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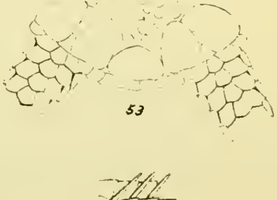
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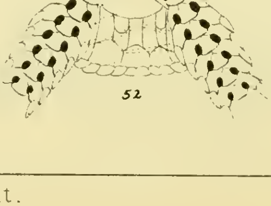
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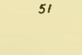
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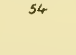
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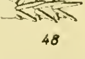
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PLATE V

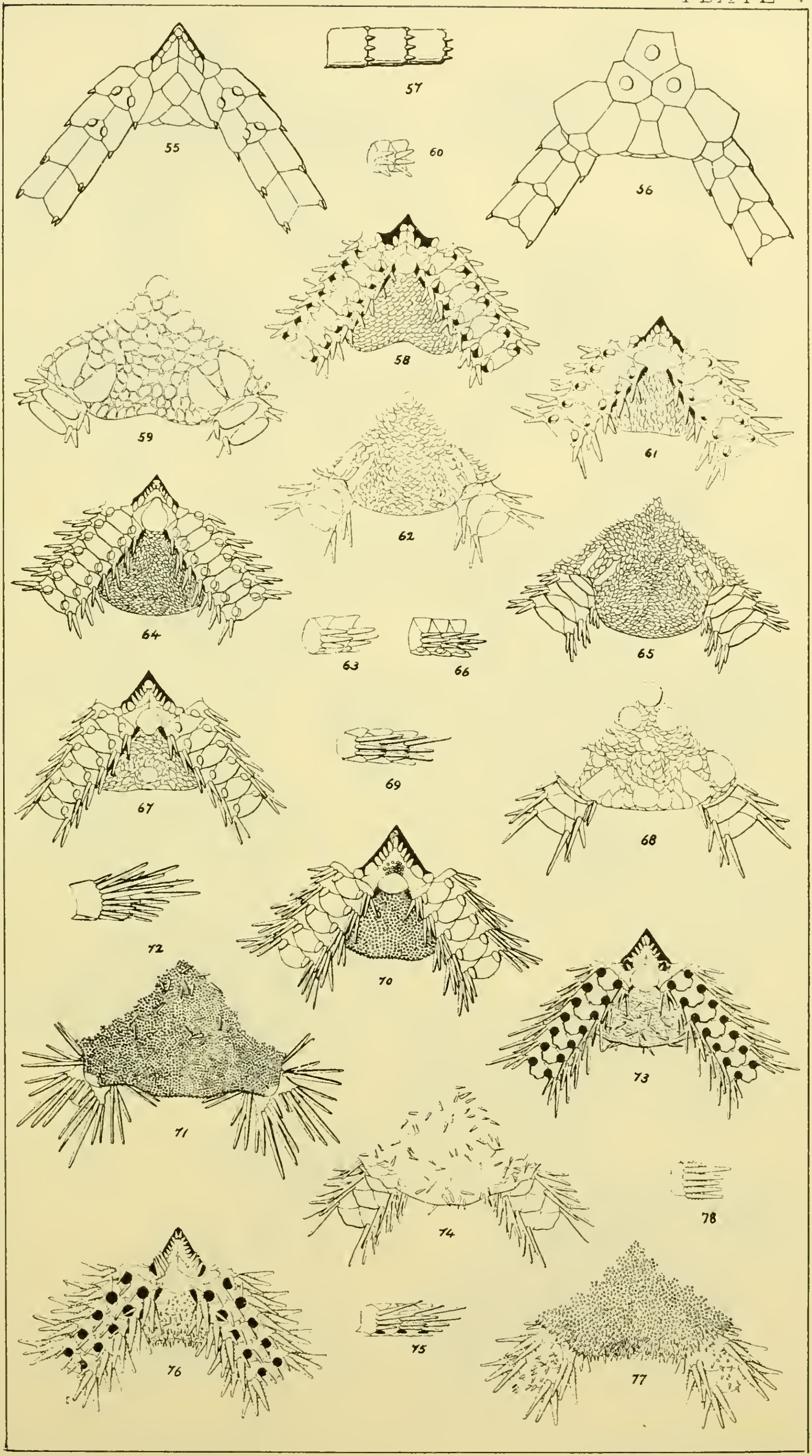
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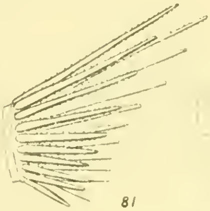
PLATE VI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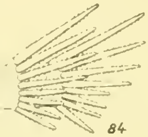
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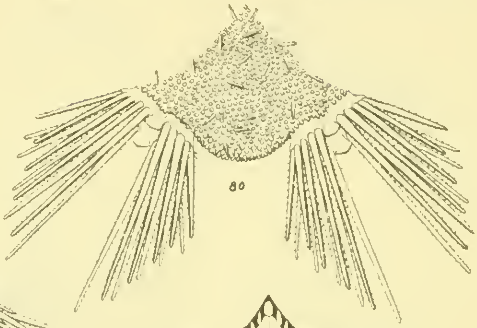
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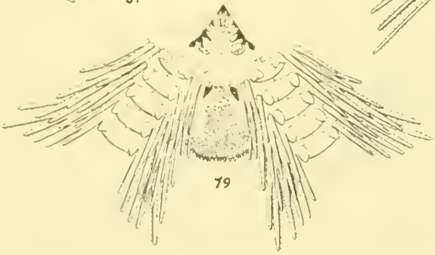
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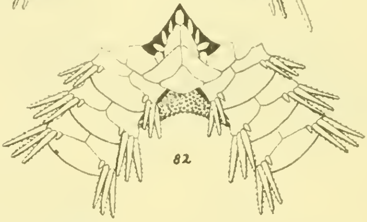
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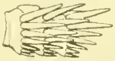
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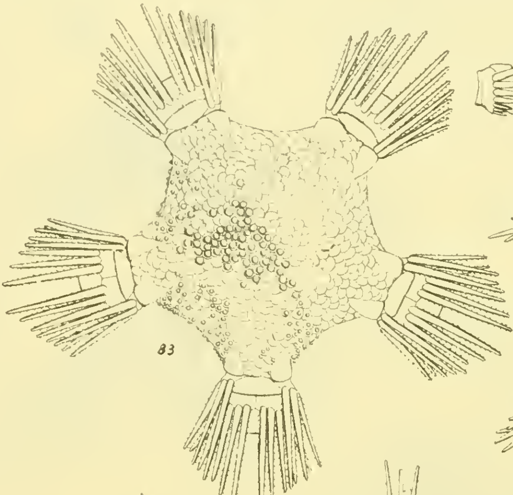
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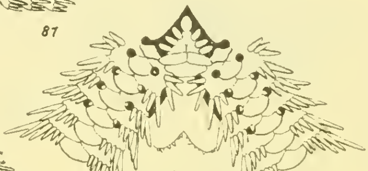
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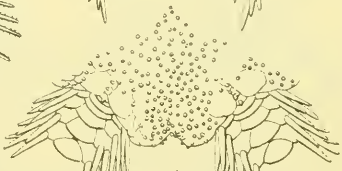
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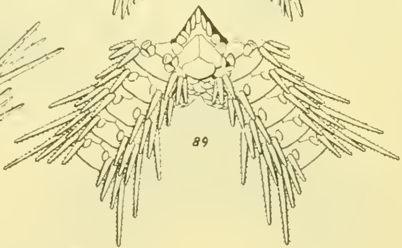
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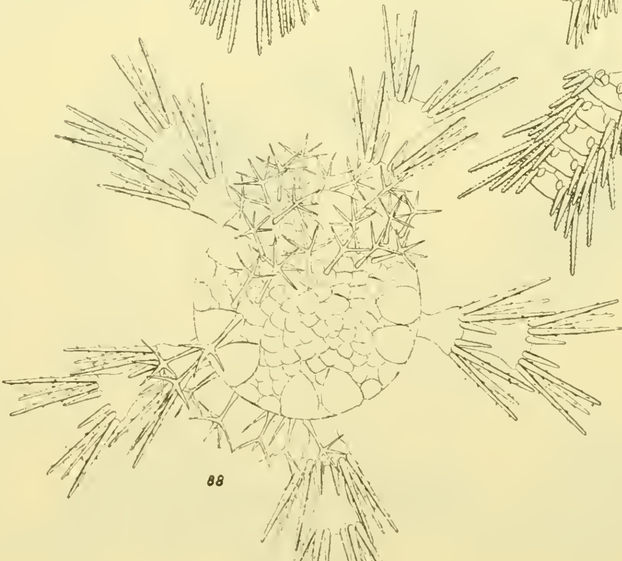
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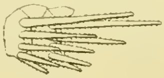
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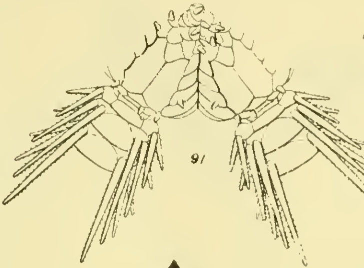
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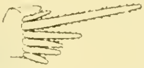
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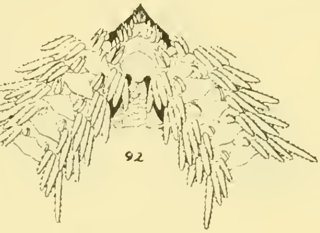
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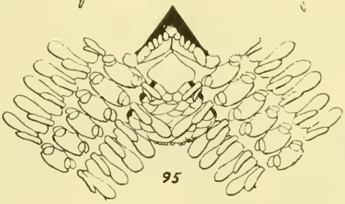
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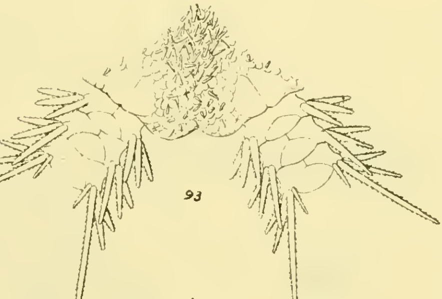
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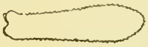
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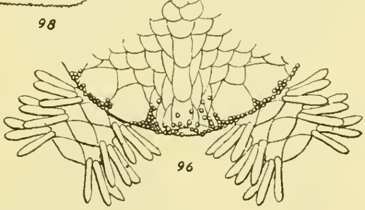
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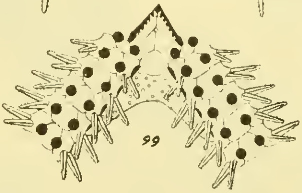
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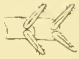
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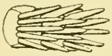
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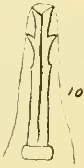
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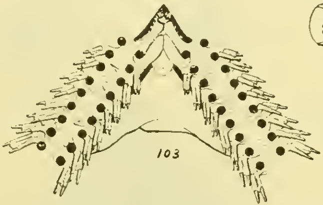
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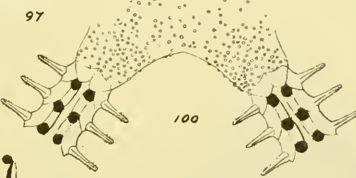
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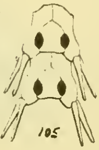
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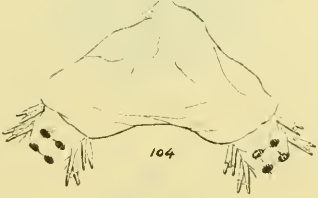
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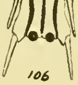
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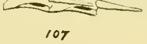
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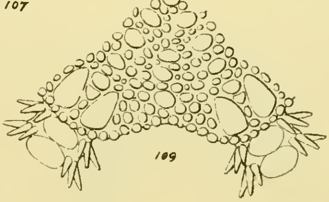
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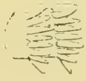
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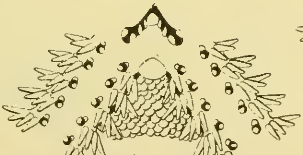
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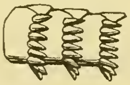
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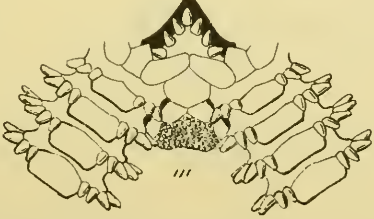
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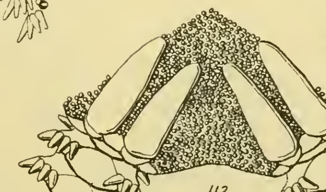
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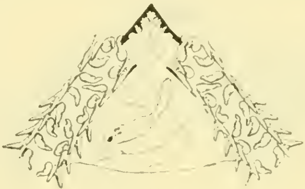
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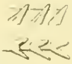
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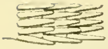
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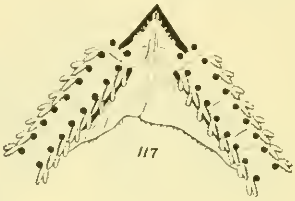
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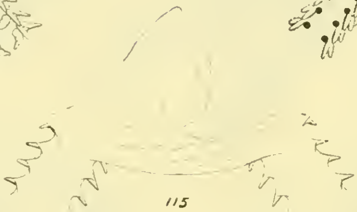
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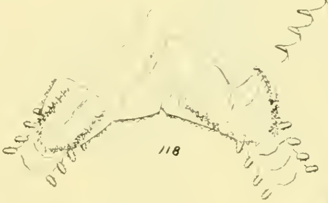
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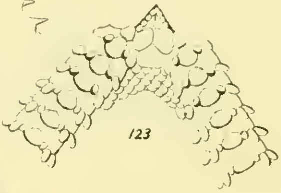
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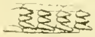
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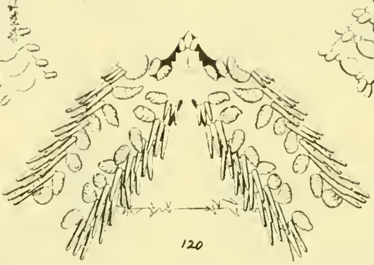
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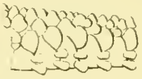
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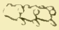
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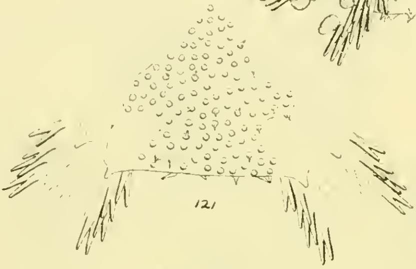
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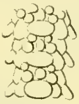
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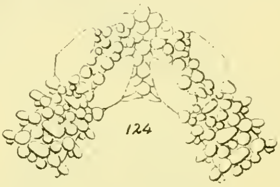
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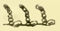
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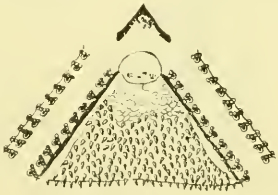
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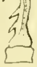
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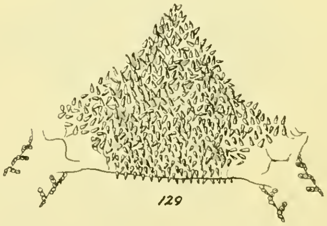
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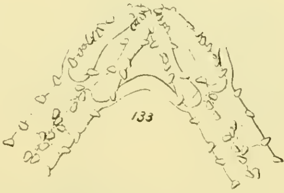
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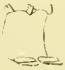
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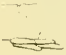
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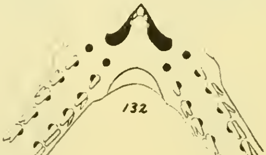
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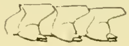
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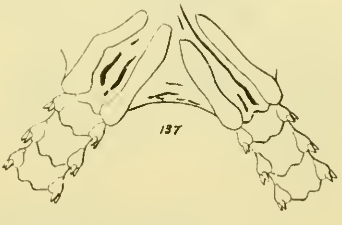
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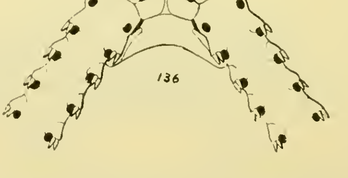
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BULLETIN

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT

HARVARD COLLEGE, IN CAMBRIDGE.

VOL. XI.

CAMBRIDGE, MASS., U. S. A.
1883–1885.

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No. 1. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *on the East Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XXI.

Report on the Anthozoa, and on some additional Species dredged by the "Blake" in 1877–1879, *and by the U. S. Fish Commission Steamer "Fish Hawk" in* 1880–82. By A. E. VERRILL.

IN order to make the following report more complete, all the species of Anthozoa dredged by the U. S. Fish Commission, during the past three seasons, in deep water along the Gulf Stream Slope, off the southern coast of New England and off Chesapeake Bay, have been combined with those dredged by the Blake along the whole coast, from off South Carolina to George's Bank. A large proportion of the species were dredged both by the Blake and by the Fish Hawk, but the collections made by the latter are much the largest, and contain a number of species not taken by the Blake. Other species, poorly represented in the collections of the Blake, were secured in large numbers, and of various ages, by the Fish Hawk. Moreover, the dredgings by the Fish Hawk having been made under the immediate supervision of the author, they have afforded him opportunities to study and make descriptions of many of the species from living specimens. Most of the drawings of the Actinians were also made by Mr. J. H. Emerton from living specimens obtained by the Fish Hawk, and kept alive in our aquaria. For the use of those drawings, on this occasion, we are indebted to the kindness of Professor S. F Baird, U. S. Commissioner of Fish and Fisheries.

A few deep-water species, that have been obtained only by the Gloucester fishermen on the deep fishing grounds off Nova Scotia and Newfoundland, and by them presented to the U. S. Fish Commission, have also been introduced, to make the list more complete. From these sources nearly all the species known to inhabit the Atlantic coast of North America, in deep water, have been derived. The "Challenger" took a few additional species, mostly in still deeper waters, at a greater distance from the coast. The present report includes, therefore, nearly all the Anthozoa hitherto discovered in depths between 100 and 1,200 fathoms, along the Gulf Stream Slope, off the coast extending from South Carolina to Cape Cod. A few well-known, more northern, deep-water species, like *Primnoa reseda* and *Paragorgia arborea*, not yet known except from the fishing banks, off Nova Scotia and northward, have been omitted, together with other northern forms that inhabit the shallower waters of New England, but extend downward beyond 100 fathoms. Among these are *Cerianthus borealis* V., *Urticina crassicornis*, *Metridium dianthus* (*marginatum*), *Bolocera multicornis*, *Cornulariella modesta*, &c. As the writer is about to print * a more detailed and illustrated report on all the Anthozoa of New England and the British Provinces, it was not thought desirable to include such species, when not in the Blake collections. Several West Indian species, mostly new, from the Blake collections of 1877–79, have been included in this report for the purpose of comparison with the northern forms, and more fully to illustrate the characters of the two families, *Ceratoisidæ* and *Dasygorgidæ*, nov., to which most of the southern species referred to belong. West Indian species, belonging to *Paramuricea* and *Acanthogorgia*, are also described for comparison with the related species from our coast.

ALCYONARIA.

PENNATULACEA.

Pennatula aculeata Danielssen & Koren.

Pennatula aculeata Danielssen, Forhandl. Vidensk.-Selsk., Christiania, 1858, p. 25; Fauna Littoralis Norvegiæ, III., 1877, p. 86, pl. 11, figs. 8, 9.
Verrill, Amer. Jour. Sci., V., 1873, pp. 5, 100; XXIII., 1882, pp. 310, 315.
Smith & Harger, Trans. Conn. Acad., III., 1876, p. 54.
Pennatula phosphorea, var. *aculeata* Sars; Kölliker, Alcyonarien, I., Pennatuliden, 1870, p. 134, pl. 9, fig. 73.
Pennatula Canadensis Whiteaves, Ann. & Mag. Nat. Hist., X., 1872, p. 346.

Plate I. Figs. 2, 2a.

This species varies considerably in form, according to the state of expansion. The stem is somewhat larger and bulbous at the end, and sometimes the swelling occurs at its upper part. The body or middle part of the rachis is sometimes considerably swollen, though in alcoholic specimens it is contracted and thin. There are a large number of small zoöids, with many more or less large, acute, spiniform, and spiculose processes among them; these are often long and conspicuous. The alæ are also variable in form. They are usually long and narrow, with a single row of spinose calicles along the edge; the edge is sometimes deeply divided between the calicles, or even lacerate.

---

* In the Reports of the U. S. Fish Commission.

The polyps (Fig. 2 a), in life, when fully expanded, have long, slender, tapering, acute tentacles, with numerous slender pinnæ, the distal ones gradually becoming very short; stem of tentacles dark red, pinnæ pale rose or whitish. The tentacles come out in the interval between the groups of spines on the edge of the calicles. When not fully extended the tips and pinnæ are incurved, and therefore appear obtuse (Figs. 2 a, 2 b).

Off Martha's Vineyard, we dredged, on the Fish Hawk, a rose-colored variety (var. *rosea* Dan.) at several localities. In one instance we also took a pure white specimen (var. *alba* V.), at Station 1025, in 216 fathoms. This is doubtless only an albino. The color is usually deep red, with the stalk rosy, becoming yellowish white at the base.

Specimens dredged by the Blake in 1880: —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
305	810	41° 33′ 15″	65° 51′ 25″	32 large and small.
306	524	41° 32′ 50″	65° 55′	2 small.
310	260	39° 59′ 16″	70° 18′ 30″	Many young.
326	464	33° 42′ 15″	76° 0′ 50″	3 young.
336	197	38° 21′ 50″	73° 32′	5 small.

This species is very abundant and widely distributed on our coasts, in 100 to 487 fathoms, on soft muddy bottoms. Gulf of St. Lawrence, 160–200 fathoms, — Whiteaves, 1871–73; Gulf of Maine, — U. S. Fish Commission, on the "Bache," 1872–73; Grand Bank, St. Peter's Bank, Banquereau, Western Bank, and other banks off Nova Scotia, in 60 to 300 fathoms, — Gloucester fishermen (in 29 lots, including about 90 specimens); off Cape Sable, N. S., 88 fathoms, — U. S. Fish Commission; off Martha's Vineyard and Block Island, and off Chesapeake and Delaware Bays, 1880, 1881, 1882, in 100–487 fathoms, — U. S. Fish Commission. Several hundreds of specimens were taken at each of the Stations 943, 945, 1025.

Christiansund, 30–100 fathoms, — Sars and Danielssen; Eastern Atlantic, 300 fathoms, — Carpenter and Thomson.

Pennatula (Ptilella) borealis Sars, sp.

Pennatula grandis Ehrenberg, Corall. rothen Meeres, 1832, p. 66 (*non* Pallas).
Kölliker, Zoöl. Voy. Challenger, I., Pt. II., 1881, p. 4.
Pennatula borealis, Sars, Fauna Lit. Norvegiæ, I., 1856, p. 17, pl. 2, figs. 1–4.
Kölliker, Pennatuliden, I., p. 136.
Verrill, Amer. Jour. Sci., XVI., 1878, p. 375; XXIV., Nov. 1882, p. 364.

Ptilella borealis GRAY, Catalogue of Sea Pens, p. 21.
VERRILL, Amer. Jour. Sci., XVII., 1879, p. 241.
Ptilella grandis KOREN & DANIELSSEN, Fauna Lit. Norvegiæ, 1877, p. 82, pl. 11, figs. 1–7 (*non* Pallas, sp.).
Pennatula (*Ptilella*) *borealis* VERRILL, Amer. Jour. Sci., XXIII., 1882, p. 310.

This very large and handsome species is common on the deep-water fishing grounds off Nova Scotia and Newfoundland. From the Gloucester fishermen over 120 specimens, mostly of large size, have been received by the U. S. Fish Commission, all of which have been examined by me. These were received in 83 lots, from 1878 to 1881. They were taken in 120 to 350 fathoms, on the outer slopes of the Grand Bank, St. Peter's Bank, Western Bank, Banquereau, Sable Island Bank, Le Have Bank, and George's Bank. Previously, it was known from only a few Norwegian specimens, from Christiansund, Bergensfjord, Lofoten, Banenfjord, etc., in 150 to 200 fathoms.

A young specimen was dredged by the U. S. Fish Commission, off Nantucket and Martha's Vineyard, in 224 fathoms, in 1881; also three large and perfect specimens, in 317 and 640 fathoms, and a very young one, in 192 fathoms, in 1882. One of the largest of these was 530 mm. (about 20.5 inches) high, and 146 mm. broad; length of the largest wings, 64 mm.; their breadth, 38 mm.; diameter of bulb, 38 mm.; length of stem, below the bulb, 112 mm. Color of the wings and rachis, in life, deep orange; upper surface of bulb, orange-red.

Among our specimens there is considerable variation in the relative size of the wings and in their form; in some cases they are long and acute-triangular; in others, they are much broader and not acute. The color varies from dull orange-yellow to deep orange-red.

Balticina Finmarchica (SARS) GRAY.

Virgularia Finmarchica M. SARS, Fauna Lit. Norvegiæ, II., p. 68, pl. 11.
Balticina Finmarchica GRAY, Catalogue of Sea Pens, p. 13.
VERRILL, Amer. Jour. Sci., XVI., 1878, p. 375; XXIII., 1882, pp. 311, 315.
Stylatula Finmarchica RICHIARDI, Monografia della Fam. Pennatularii, 1869, p. 69.
Pavonaria Finmarchica KÖLLIKER, Pennatuliden, 1871, p. 243 (*non Pavonaria* Cuvier).

Plate I. Figs. 3, 3a.

A young specimen of this species, in the collection, is 70 mm. long; 3 mm. broad, across the polypiferous part; the barren peduncle is 35 mm. long; 2 mm. in diameter. Where most developed, there are two polyps in each oblique row, supported by two-lobed spiculose calicles; between the wings there are four to six scattered zoöids. Toward the upper part of the peduncle there is but one well-developed polyp, with or without an additional young bud, in the oblique rows; and here the calicles have the apex bilobed only slightly, or not at all and terminating in a single pointed group of spicula. This part agrees essentially in structure with the genus *Microptilum* Kölliker (Challenger Voyage, Pennatulida, p. 26).

Another specimen is abnormal; it is 71 mm. long, the peduncle occupying 40 mm. There are about fifteen transverse rows of polyps on each side, but the uppermost ones are small, imperfectly developed, and pale, as if in process of restoration after they had been injured or destroyed. The middle rows have about five well-developed polyps, resembling those on much larger specimens.

In life the color of the polyps is dark purplish brown; stem and rachis, pale salmon; base of stem, orange.

This species often has the upper part of the axis, for a greater or less extent, denuded, and occupied by one or more specimens of an actinian (*Actinauge nexilis*, Plate VI. figs. 4, 5). Sometimes the denuded place thus occupied is not terminal, but along some part of the rachis. I have seen specimens with an actinian only 3 or 4 mm. in diameter attached to a small bare spot on the side of the rachis, but its broadly expanded base had already insinuated itself beneath the cœnenchyma, and completely clasped the axis of the *Balticina*. This actinian has, in a remarkable degree, the habit of thus clasping the axis of this polyp, and other similar objects, by its base, and the edges of the basal disk, when they meet, unite together in a suture. When two or more are attached near together, their margins unite where they come in contact.

Specimens dredged by the Blake in 1880 : —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
307	980	41° 29′ 45″	65° 47′ 10″	1 young.
310	260	39° 59′ 16″	70° 18′ 30″	1 injured and dwarfed.

Several specimens were trawled by the U. S. Fish Commission, off Martha's Vineyard, in 160 to 238 fathoms, in 1880, 1881, and 1882. The Gloucester fishermen have presented many large and fine specimens (more than 75), some of them over two feet long. These came in 57 lots, from the outer slopes of the Grand Bank and all the banks off the Nova Scotia coast, in 60 to 400 fathoms. It was previously known from off Finmark, 240 fathoms; Bergenfjord, 300 fathoms.

Anthoptilum grandiflorum Verrill.

Virgularia grandiflora Verrill, Amer. Jour. Sci., XVII., March, 1879, p. 239.
Anthoptilum Thomsoni Kölliker, Zoöl. Voy. Challenger, Pennatulida, 1881, p. 13, pl. 5, figs. 16–18.
Anthoptilum grandiflorum, Verrill, Amer. Jour. Sci., XXIII., 1882, pp. 312, 315.

Plate I. Fig. 6.

This large species was dredged by the Blake, off North Carolina, in 603 and 647 fathoms, in 1880. A specimen, apparently identical, had previously been taken by the Blake, off Guadeloupe, in 734 fathoms, in 1878–79.

List of specimens dredged by the Blake in 1878–80 : —

Station.	Fathoms.	Locality.	Specimens.
173	734	Off Guadeloupe.	1 medium size.
325	647	N. Lat. 33° 35′ 20″, W. Long. 76°	1 good size.
329	603	" 34° 39′ 40″, " 75° 14′ 40″	1 " "

Taken also by the U. S. Fish Commission, off Martha's Vineyard, in 302 to 310 fathoms. Its color, in life, is usually deep salmon-brown, but varies to pale salmon, and even to yellowish white.

The Gloucester fishermen have presented to the U. S. Fish Commission about forty specimens, in twenty lots. These are from near the Grand Bank, St. Peter's Bank, Western Bank, Banquereau, Sable Island Bank, and Le Have Bank, in 85 to 300 fathoms.

In the Zoölogy of the Challenger,* Dr. Kölliker described *A. Thomsoni*, from off Buenos Ayres, in 600 fathoms. It is a large species, apparently identical in all respects with my species, from off Nova Scotia and New England.

Funiculina armata Verrill.

Funiculina armata Verrill, Amer. Jour. Sci., XVII., 1879, p. 240; XXIII., 1882, pp. 312, 315.

Plate I. Figs. 4, 4 a, 4 b.

Rachis long, slender, with large, urceolate, rigid, spiculose polyp-calicles, armed at the aperture with eight sharp, divergent, spiculose points. Axis and rachis quadrangular, the sides of the axis concave. The polyp-calicles are entirely separate and arranged in numerous irregular, transverse clusters, of two to four smaller and larger ones intermingled; they are so stiffened by spicula as to be scarcely flexible, and retain well their form; they are elongated, swelling out gradually from near the base, and tapering again above the middle, to near the summit, which suddenly expands to the edge, from which eight acute, rigid, white points diverge. The tentacles are spiculose, but wholly retractile within the calicles; they are situated between the divergent points of the calicles, in expansion.

The zoöids are scattered along the middle of the polypiferous side of the rachis, and also between the rows of polyps; they are prominent and rather large, though much smaller than the polyps, contracted at the base and enlarged at the end, with eight rudimentary tentacles.

Stem light brownish yellow or buff at base, becoming orange-brown or dark purplish above; calicles dark reddish brown or deep purple, the whitish spicula visible in eight chevron lines; zoöids pale yellow or light salmon with purplish stripes; tentacles dark brownish red.

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* The Zoölogy of the Voyage of H. M. S. Challenger, Vol. I. Part II., Report on the Pennatulida, by Professor Albert V. Kölliker, 1880.

Height, 600 mm.; diameter of rachis, near base, 1.5 mm.; in middle, about 1 to 1.5 mm.; length of larger polyp-calicles, about 6 mm.; diameter, 1.5 to 1.75 mm. Larger ones have been obtained.

The spicula (Fig. 4 a) of the calicles are long and slender, prismatic, with strong lateral angles, or ribs, which are a little winding; they usually taper a little to the ends, which are not very acute. The larger ones measure .92 by .04, .82 by .05, .82 by .037, .80 by .03, .50 by .03 mm.

This was first described from a specimen taken in December, 1878, in 300 to 400 fathoms, about forty miles southwest from the N. W. Light of Sable Island, N. S., by George K. Allen, of the schooner "M. H. Perkins." Other specimens were afterwards brought in by the Gloucester fishermen, from the fishing banks off Nova Scotia.

Two specimens were dredged by us, on the U. S. Fish Commission steamer Fish Hawk, in 1880, off Martha's Vineyard, in 252 and 325 fathoms.

It was dredged by the Blake in 1878–79, in the Caribbean Sea.

List of specimens dredged by the Blake, 1878–79: —

Station.	Fathoms.	Locality.	Specimens.
135	450	Off Santa Cruz.	4 small.
136	508	" "	2 small.
163	769	Off Gaudeloupe.	1 l. broken.

Kophobelemnon scabrum Verrill, sp. nov.

Plate I. Figs. 5, 5 a, 5 b, 5 c.

Body clavate, with a long stem, swollen above. About eight large prominent polyps are rather irregularly arranged on the two sides and in front, near the top, leaving a naked band on the backside, which is covered with small prominent zoöids. Similar zoöids occur between the polyps, and entirely surround the rachis, below the polyps, and eight longitudinal rows run down on the stem; four of the rows are longer than the others, and extend over the swollen part of the stem. The stem terminates in a bulb, at the base, which is sulcated by several grooves in our example; above the bulb it is slender, and then gradually swells into the bulbous portion, a short distance below the polyps; the surface is finely spiculose. The polyps arise from the summits of large, swollen, mamillary elevations; some of them are entirely retracted, but most of them have the lower part of the body exposed, in the form of a strongly eight-ribbed, verruciform tubercle, which is densely spiculose, like all other external parts. The zoöids are rather large, obliquely appressed, and directed upward; they vary considerably in size. Axis round, slender, extending from the apex to near the base. Color in alcohol, light gray.

Height, 56 mm.; breadth across body, 8 mm.; diameter of swollen part of stem, 2.5 mm.; diameter of contracted polyps, 3 mm.

The integument is firm and coriaceous, with a rough surface, owing to an abundance of small slender spicula, which lie at various angles and in several strata; these are small, fusiform or oblong rods and prisms. Some of them are long, slender, triquetral, and nearly smooth (Fig. 5 b, *d*), or sparingly warted near the ends; the larger of these measure .35 by .03 mm. to .29 by .03 mm. Others are shorter, more rod-like, and covered with scattered, minute, conical, obtuse warts (Fig. 5 c); some of these are swollen in the middle with prominent warts; most of them are roughened and obtuse at the ends; they measure .25 by .025, .23 by .025, .20 by .03, .20 by .025, .15 by .02, .14 by .015 mm. Some of smaller size (.10 by .015 mm.), but similar in form, are strongly warted all over (Fig. 5 b, *e*).

A single specimen was taken south of George's Bank, at Station 307, in 980 fathoms, N. Lat. 41° 29′ 45″, W. Long. 65° 47′ 10″.

Distichoptilum Verrill.

Amer. Jour. Sci., XXIV., Nov. 1882, p. 362.

Slender pennatulids, with an axis through the whole length. Polyps arranged alternately, in a simple row, on each side. Calicles bilobed, appressed. Zoöids three to each polyp, one in front and one on each side of each cell. Spicula abundant in the calicles, rachis, and stalk; those in the stalk are small, oblong, triquetral, interwoven.

Distichoptilum gracile Verrill.

Amer. Jour. Sci., XXIV., Nov. 1882, p. 362, note.

Plate I. Figs. 1, 1 a, 1 b.

Long and slender, with a long stalk. Polyp-calicles rather large, rigid, closely appressed, with two sharp terminal lobes, filled with spicula, concealing the opening, and overlapping the base of the calicle in front. Zoöids small, not exsert, showing as small white spots at each side and in front of each calicle. Stalk long, slender, with a long narrow bulb. Color bright orange-red, due to the spicula; end of bulb yellowish.

Length, 18 inches, or 456 mm.; breadth in middle, 2 mm.; length of stalk, 100 mm.

The spicula of the calicles and rachis are long, triquetral, both oblong (Fig. 1 b, *c*) and fusiform, obtuse or acute at the ends, varying in slenderness; those of the stalk (Fig. 1 b, *d*) are much smaller, of the same general form, but mostly oblong, with obtuse ends.

A single perfect specimen of this curious species was taken by the U. S. Fish Commission, August 26, 1882, at Station 1123, in about 700 fathoms, S. E. of Nantucket Island, in N. Lat. 39° 59′ 45″, W. Long. 68° 54′.

Attached to this specimen was a fine example of *Astronyx Loveni*, which had the same bright orange-red color as the coral. In alcohol, however, this ophiuran rapidly lost its color, while that of the coral was not much altered.

GORGONACEA.

Family CERATOISIDÆ.

Keratoisidæ + *Acanelladæ* + *Mopseadæ* (*pars*) GRAY, Cat. Lithophytes Brit. Mus., 1870, pp. 13, 16, 18.

Axis simple or variously branched, with long calcareous joints, which are often hollow, alternating with shorter horny joints. Branches, when present, sometimes arise from the calcareous joints, but more frequently from the horny ones. Base calcareous, usually divided into long, flat, irregular lobes, serving as anchors in the mud of the sea bottom. Cœnenchyma thin, commonly with long fusiform conspicuous spicula, sometimes with small scale-like ones at the surface. Calicles large and prominent, filled with large fusiform spicula, of which eight or more are larger than the rest and commonly project as sharp marginal spines between the bases of the tentacles, forming an armature for the protection of the incurved and imperfectly retracted tentacles.

This group bears about the same relation to *Isidæ* that *Muricea* does to *Plexaura* and *Eunicea* among the Gorgonians with a horny axis. In typical *Isis* the cœnenchyma is thick and filled with minute spicula, and the calicles are not prominent nor armed with spines.

Neither the mode of branching, nor the fact that the branches in some species arise from the horny, and in others from the calcareous joints, is a sufficient reason for separating the very closely allied genera here included into different families, as was done by Dr. J. E. Gray.

This family includes three well-marked genera that are found on our coast, viz. *Ceratoisis*, *Acanella*, and *Lepidisis*, nov. In addition to these, *Callisis* occurs in the Straits of Florida. The imperfectly known and not properly characterized genus, *Isidella* Gray, should probably be referred here, if it be recognized at all. These genera may be arranged as follows: —

A. *Branches arise from the calcareous joints.*

Ceratoisis. Cœnenchyma and calicles filled with large fusiform spicula. Calicles armed.

Callisis. Cœnenchyma with small oblong scales. Calcareous joints solid, or nearly so. Calicles with fusiform spicula, which do not form long marginal spines. Type, *C. flexibilis* V. (= *Isis flexibilis* Pourtalès).*

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* *Callisis flexibilis* (Pourt. sp.). The type-specimen of this species has prominent, short cylindrical calicles, containing moderately large, rather short, blunt, oblong and fusiform, minutely warted spicula, not running the whole length of the calicles, and projecting very slightly, or not at all, beyond the margin. The cœnenchyma is thin, brown, filled with minute oblong or elliptical, flat, scale-like spicula, which also cover the surface of the calicles. The branches arise from near the proximal end of the calcareous joints, in the specimen examined. The calcareous joints, in the several broken branches examined on different specimens, were solid, or rarely had a very minute central tube.

AA. *Branches, if present, arise from the horny joints.*

Acanella. Cœnenchyma and calicles filled with large fusiform spicula. Calicles armed.

Lepidisis. Calicles filled with large fusiform spicula. Cœnenchyma with a layer of small oblong scales. Calicles armed.

Isidella (?). Cœnenchyma and calicles with fusiform spicula. Calicles unarmed (?).

Nearly all the known species of this group, including the largest and most luxuriant ones, are from comparatively deep water, and consequently require cold, or at least cool temperatures. Several species are arctic, or inhabit the deep fishing banks off the northern coasts of Europe and America, where they are bathed in the cold arctic currents. Some of the species are found at great depths (1,000 to 1,300 fathoms), where the temperature is very low. The group is well represented in the deep waters of the Caribbean Sea and Gulf of Mexico. At least nine species, belonging to the four principal genera, were taken in those waters by the "Blake" expeditions, 1877 to 1880. Among these there were certainly two, and perhaps three, of our northern species.

For the sake of comparison, I have added brief descriptions and a few figures of some of the West Indian forms of *Acanella* and *Lepidisis.*

Ceratoisis Wright.

Keratoisis Wright, Ann. and Mag. Nat. Hist., II., 1869, p. 427; III. p. 24. Gray, Cat. Lith. Brit. Mus., 1870, p. 18.

In this genus the branches, which are usually few and distant, arise from the calcareous joints. Otherwise it agrees very closely with some of the sparingly branched species of *Acanella.* Indeed, it is difficult to determine to which genus some of the unbranched species should be referred. The calcareous joints are tubular. The calicles are strongly armed with large spiniform spicula, and the cœnenchyma also contains large fusiform spicula.

In this genus are included the largest known species of the family. Some specimens of *C. ornata* are more than four feet high. These are found at considerable depths, in cold water, off the coasts of Newfoundland and Nova Scotia.

Ceratoisis ornata Verrill.

Keratoisis ornata Verrill, Amer. Jour. Sci., XVI., 1878, pp. 212, 376.

Plate IV. Figs. 3 - 3 d.

Coral tall (sometimes over three feet high), distantly and irregularly branched, the branches spreading, often nearly at right angles, elongated, rather slender, gradually tapering, giving off, in the same manner, elongated branchlets. The branches and branchlets mostly arise from near the proximal end of the calcareous joints, but sometimes from the middle. The calcareous joints are ivory-white, elongated, round, slightly enlarged at the ends, usually faintly and often indistinctly striated longitudinally, appearing smooth to the naked eye, but finely granulous under a lens; they are tubular, having a central tube equal to about a third or a fourth of their total diameter. Chitinous joints are usually golden yellow or bronze-color, sometimes plain brown, short, scarcely longer than thick in the larger branches, about twice as long as thick in the smaller ones, where they become translucent and brownish or amber-color, without the metallic lustre seen in those of the larger branches.

The calicles are usually, in dried specimens, prominent, elongated, somewhat expanding toward the end, and are crowded nearly equally over the whole surface; they are covered with large, conspicuous, acute spicula, which form, at summit, eight sharp projecting spinous points. The cœnenchyma is thin, translucent, yellowish, filled with long and large fusiform, conspicuous spicula.

A large specimen, well preserved in alcohol, from the Gloucester fisheries, lot 367, shows remarkable variations in the length and form of the calicles. Over most of the branches they are very long and prominent, constricted in the middle, with an expanded base and enlarged summit, crowned by eight prominent spines, surrounding the incurved and nearly retracted tentacles (Fig. 3 a). In this form of calicle the length is two to three times the average diameter. But on other branches the calicles are only prominent, subconical verrucæ, broadest at base, with the summit narrow, and the spines but little prominent (Fig. 3 b); these are often about as broad as high. Intermediate forms also occur on this specimen. The calicles are irregularly but rather uniformly scattered over the whole surface, and are mostly separated by spaces two or three times as great as their breadth, though some are in contact at their bases. The surface of the cœnenchyma and calicles in this example is covered with a soft integument, which nearly conceals the spicules, except at the border of the calicles; but they become conspicuous when dried. This example also has the basal part, which is deeply divided into irregular, palmate, flattened lobes, or root-like expansions, by means of which it anchors itself in the mud.

The large projecting spicula of the calicles are fusiform, usually more or less bent, and either acute at both ends or acute at the outer end and obtuse at the inner (Fig. 3 c, *e*); the surface is nearly smooth, or only slightly roughened in longitudinal lines on the basal part, or sometimes throughout, but in many cases the longitudinal lines of points become more evident on the inner end. They have a large yellowish brown nuclear portion. The larger of these measure 4.40 by .35, 4.10 by .33, 4.10 by .30, 3.90 by .25, 3.80 by .30, 3.70 by .22, 3.60 by .30, 3.00 by .30, 3.00 by .20 mm.

With these, below the margin, and in the polyps, there are many smaller and more slender, partly fusiform, partly oblong or rod-like spicula, with both ends similar, and either acute or obtuse, and usually distinctly but finely lined and roughened longitudinally and obliquely, especially near the ends, which are often swollen, and as broad as the middle (Fig. 3 d, *f*, *g*). These measure 2.50 by .15, 2.30 by .20, 2.25 by .15, 2.22 by .13, 2.20 by .18, 2.20 by .15, 2.20 by .10, 2.10 by .10, 1.90 by .15, 1.80 by .15, 1.80 by .11 mm.

In the tentacles there are numerous smaller, oblong, or somewhat hour-glass-shaped spicula, of various sizes, mostly enlarged, obtuse and striated at both ends (Fig. 3 d, *h*, *i*). The larger of these measured .65 by .10, .45 by .06, .45 by .05, .30 by .03 mm.

The cœnenchyma contains large, scattered, fusiform spicula, finely striated longitudinally, and mostly acute at both ends, which are covered with small spiniform or conical warts, in rows. The larger of these measure 4.20 by .03, 4.10 by .025, 3.50 by .02, 3.50 by .018, 3.40 by .025, 3.20 by .02, 3.15 by .015, 2.80 by .02, 2.70 by .02, 2.65 by .015, 2.60 by .022, 2.40 by .02 mm. These large spicula are mostly nearly straight, but some are bent more or less. They are accompanied by a few much smaller fusiform spicula, acute at both ends, and by still smaller oblong ones, obtuse at the tips. These are from .015 to .023 mm. long, by about .004 to .005 mm. thick.

The largest specimen seen, which, however, lacks the base, was 1020 mm. (about 40 inches) in height; diameter of the main stem, not including calicles, 7 mm.; length of calicles, mostly 5 mm.; their diameter, about 2 mm.; length of calcareous joints of stem, about 50 to 70 mm.; of horny ones, 4 to 4.5 mm. One branch was 675 mm. (about 27 inches) long without dividing.

Height of one of the original specimens, 660 mm. (about 26 inches); breadth, 458 mm. (about 18 inches); length of longest undivided branchlets, 300 to 400 mm. (about 12 to 16 inches); diameter of calcareous joints of main stem (base absent), 9 mm.; of the larger branches, 5 mm.; length of the calcareous joints, in the larger branches, 30 to 48 mm., but mostly about 40 mm.; diameter in smaller branchlets, about 1.5 mm.; length, 19 to 32 mm.; length of chitinous joints of larger branches, 2.5 to 5 mm.

The two original specimens were taken, in 1877, by Mr. Philip Merchant, of the schooner "Marion," off Sable Island, N. S., in about 250 fathoms, and another was taken by Mr. George K. Allen, of the same vessel. Several other specimens have subsequently been obtained by other vessels of the Gloucester fishing fleet, from the banks off Nova Scotia, where it occurs in 200 to 300 fathoms. It was not taken by the Blake.

This is a large and beautiful species of a family formerly considered chiefly tropical in habitat, but now known to be peculiarly characteristic of rather deep water in all latitudes. The golden or bronzy chitinous joints usually contrast finely with the clear ivory-white calcareous joints.

The genus was founded by Professor E. Perceval Wright, in 1869, for a species (*C. Grayi* W.) very closely allied to this, and taken in deep water (400 fathoms) off the coast of Portugal.

A closely allied species, perhaps identical, was found in deep water in the Caribbean Sea by the Blake, in 1878–79; but the specimen is a fragment too imperfect to be readily identified.

Acanella Gray (emended).

Acanella Gray, Cat. Lithophytes Brit. Mus., 1870, p. 16.

Coral either simple or variously branched. Axis with long calcareous joints and very short horny ones. The branches, when they exist, arise from the horny joints, either singly or two or more together, sometimes forming whorls. Cœnenchyma very thin, containing, more or less abundantly, elongated fusiform spicula, usually of large size. Calicles large, elongated, composed of large, fusiform spicula, often obliquely arranged; the margin is armed by about eight long, spine-like, projecting acute spicula. Tentacles stiffened by abundant spicula. Base, in most cases, divided into large, flat, palmate lobes, which descend into the mud and serve as supporting roots or anchors.

This genus, as established by Gray, for *A. arbuscula* Johnson, had as one of its most prominent characters the verticillate arrangement of the branches. The discovery of several closely allied species without this peculiarity, one of them being entirely simple, shows that the mode of branching, as in most other genera of Gorgonacea, is only a specific character.

The relation of this genus to *Isidella* Gray is still doubtful, for the nature of the cœnenchyma and calicles of the type-species of the latter was unknown to Gray. Indeed, the precise species which he had in view is very doubtful, although he referred it to *I. elongata* Esper, a species that had never been properly described, and which could not be positively identified, as it was based on the axis only. The species described under the same name by Philippi is probably a distinct species, having elongated calicles, with long projecting spicula, as in *Acanella.*

I have hitherto referred to *I. elongata*, a species procured at Naples, many years ago, by Professor J. D. Dana, and of which several specimens, consisting of the axis alone, are in the Museum of Yale College. So far as the axis shows, these might belong either to *Acanella* or to *Lepidisis,* or to a genus distinct from either.

Koch has described a species, perhaps the same, under the name of *Isis Neapolitana*, which may be the species intended by Gray as the type of *Isidella*, and which is apparently the same as my *I. elongata* from Naples. In this species the calicles are not furnished with the projecting spicula, so conspicuous in *Acanella* and *Lepidisis.* The corresponding spicula are present, however, according to the figures given by Koch, as fusiform spicula, larger than the others, but not projecting beyond the margins of the elongated calicles. The cœnenchyma is thin, and contains small fusiform spicula. This species is, therefore, closely allied to *Acanella*, the principal difference being the less development of the marginal spines of the calicles. Possibly this may be the species called *Isidella elongata* by Gray, but it would be difficult to prove it. Therefore it might be best to reject the name, *Isidella*, as not recognizably established. Otherwise it might be restricted to such species as *I. Neapolitana* and *I. borealis* (= *Mopsea borealis* G. O. Sars), in which the marginal spines are not much developed and do not project.

Acanella Normani Verrill.

Acanella arbuscula Norman, Proc. Royal Soc. London, 1876, p. 210 (? *non* Johnson, 1862).

Acanella Normani Verrill, Amer. Jour. Sci., XVI., 1878, p. 212 (descr.); XXIII., 1882, p. 315.

Plate IV. Figs. 2, 2 a, 2 b.

This coral grows in symmetrical, thickly branched, bush-like forms, usually 6 to 10 inches high, and 6 to 8 inches broad. The base is calcareous, and divides into several large, divergent, irregularly palmate and digitate lobes or root-like branches, which serve to anchor and support the coral on the soft muddy bottoms which it usually inhabits; occasionally, however, the basal expansion attaches itself to pebbles, and in that case becomes incrusting, in part or wholly, according to the size of the pebble. The main central stem usually grows upright, in normal specimens, commonly with a short trunk, 25 to 50 mm. (1 to 2 inches) long, destitute of branches; above this the main branches are given off symmetrically, from the short horny joints, mostly in whorls of four at each of the joints, which are usually from 15 to 20 mm. apart. The branches are strongly divergent and spreading, and they give off from their horny joints similar whorls of branchlets, usually three or four to each joint; these are usually somewhat farther apart than those of the main stem, commonly 20 to 25 mm. The smaller branches are slender, with longer calcareous joints, and they give off slender branchlets from their horny joints, only one or two usually arising from a joint. The terminal branchlets are long, slender, divergent, with longer calcareous joints than the larger branches. The main stem and most of the larger branches are destitute of calicles, and along the smaller branches they are rather distantly and irregularly scattered, becoming more numerous, closer, and larger on the terminal branches, and especially toward their tips, where there is often a group of two or three, or more.

The calicles are long and prominent, divergent, and nearly rigid, owing to the large and long spines with which they are filled; they vary considerably in size and form, those at the tips of the branches (Fig. 2 a) being somewhat larger and better developed than most of those along their sides. These larger calicles are swollen at base, narrowed or subpedunculated just above the base, and then gradually enlarged toward the summit, where the margin is surrounded by eight long, slender spines, formed by the projecting ends of the large spicula; within the marginal spines the incurved tentacles are usually to be seen in alcoholic specimens. Below the margin the calicles are composed of numerous long, slender warted spicula, which vary considerably in size and form; those on the swollen basal portion are smaller, crowdedly imbricated, but do not project. The spicula are conspicuous in dried specimens, in which they are commonly less regular, and take oblique and more or less twisted positions. The calicles along the sides of the branches are irregularly arranged, and less regular in size and form than the terminal ones, but have the same structure; many of them agree closely in size with the terminal ones, and may be four to six times as long as broad; others are less than half as large; some stand very obliquely, but the larger ones usually diverge from the branch at a large angle, and then curve upward; they are obliquely seated upon the branchlets, with the bases swollen, and often larger than the branches which support them.

The cœnenchyma is thin and filled with long, slender, mostly fusiform or rod-shaped, finely warted spicula, which are not very numerous.

The spicula, both of the calicles and the cœnenchyma, are mostly long, slender, fusiform, often a little bent, and acute at one or both ends, minutely spinulated, and of various sizes. The largest, from the margins of the calicles, are usually smoother, more slender, and sharper at the outer or projecting end than at the other, which may be subacute or blunt, with the spinules more distinct and in rows (Fig. 2 b, *c*). Others are relatively stouter, regularly fusiform, with both ends alike, and either obtuse or acute; smaller ones (Fig. 2 b, *d*, *e*) of these forms occur, especially in the swollen basal portion.

Some of these various forms gave the following measurements: 3.10 by .14, 3.00 by .12, 2.90 by .12, 2.80 by .12, 2.60 by .09, 1.90 by .08, 1.80 by .08, 1.36 by .08, 1.30 by .07, 1.25 by .10, 1.04 by .06 mm.

Among the smaller forms (Fig. 2 b, *f*), many are slender, oblong, obtuse at both ends, and sometimes narrower in the middle. Some of these measured .36 by .06, .36 by .04, .23 by .03, .18 by .03 mm. Others are oblong or slightly fusiform, acute at both ends. Some of these measured .86 by .06, .86 by .04, .84 by .06, .80 by .06, .64 by .04 mm. The smallest (probably from the tentacles) are slender, oblong, mostly of nearly uniform diameter, or else a little larger at one end, obtuse or subacute, distinctly spinulated, most so in the middle or toward one end. Occasionally large, compound, cross-shaped spicula occur.

Color of stem, branches, and calicles, in life, light salmon to orange; tentacles translucent, whitish, stiffened by white spicules. In alcohol the color is not much changed. When dried the color usually becomes darker orange, or orange-brown.

This is an abundant species all along our coast, from off Chesapeake Bay to Newfoundland, at considerable depths.

It was taken by the Blake, in 1880, at a number of stations along the Gulf Stream Slope, from off George's Bank to the region south of Long Island, in 260 to 1,242 fathoms.

It has been dredged and trawled in great abundance by the U. S. Fish Commission, at many stations, in 219 to 640 fathoms, along the Gulf Stream Slope, from off Nantucket and Martha's Vineyard to the region off Chesapeake Bay, in 1880, 1881, and 1882. It was particularly abundant at Station 881, in 325 fathoms;. Station 893, in 372 fathoms; Station 938, in 317 fathoms; Station 947, in 312 fathoms; Station 1029, in 319 fathoms.

It has also been brought, in considerable numbers and in many lots, from the deep fishing grounds off Newfoundland and Nova Scotia, by the Gloucester halibut fishermen. Off Greenland, "Valorous" Expedition, — Norman.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
306	524	41° 32′ 50″	65° 55′	5 in bad state.
307	980	41° 29′ 45″	65° 47′ 10″	4, with fragments.
308	1242	41° 24′ 45″	65° 35′ 30″	7 in bad state.
309	304	40° 11′ 40″	68° 22′	13
310	260	39° 59′ 16″	70° 18′ 30″	Sev. fragments.
312	466	39° 50′ 45″	70° 11′	12 in bad state.
339	1186	38° 16′ 45″	73° 10′ 30″	1, with fragments.

This species is closely allied to the *Acanella arbuscula* (Johnson) Gray, described from off Madeira, in 1862. It may, in fact, ultimately prove identical when the specimens can be directly compared. The figure of *A. arbuscula* indicates a more diffusely branched form, with more slender branches and branchlets. The calicles, also, judging from the figure, are different in form, but this might be largely due to distortion in drying. The Arctic form described by Norman under this name is evidently identical with our species, but the use of the same name was, apparently, accidental, as he did not refer to Johnson's species.

From the Bay of Yeddo, Japan, I have several specimens of an *Acanella* without the cœnenchyma, which I cannot distinguish by the axis alone from *A. Normani.* They were collected by Professor E. S. Morse.

Acanella eburnea (Pourtales) Verrill.

Mopsea eburnea Pourtales, Bull. Mus. Comp. Zoöl., I., 1868, p. 132.

Plate IV. Fig. 5.

Loosely and not very abundantly branched, the branches arising from the horny joints, sometimes singly, sometimes two or three from one joint, but not forming whorls in any of the specimens examined. The branches are often crooked, slender, and usually spread widely at the base. The calcareous joints are long, slender, translucent white, distinctly grooved, and solid, in both the larger and smaller branches examined; the horny ones are short, dark brown or brownish yellow. The calicles are decidedly swollen at the base, and usually broader than the small branches on which they are obliquely set; they usually taper distally, and the slightly expanded margin is armed with eight large, sharp, spinous spicula, which are minutely warted or spinulated over the whole surface. Below the margin the calicles are covered with numerous and crowded, much smaller, slender, finely warted spicula, which are arranged obliquely or somewhat spirally below the middle. The cœnenchyma is very thin; near the calicles, and especially near the ends of the branches, the spicula are much like those of the lower part of the calicles, but elsewhere they are smaller oblong forms, blunt at both ends. The terminal calicles on the outer branchlets are the largest and most prominent; those on the sides of the larger branches are shorter, oblique, and verruciform, with swollen bases.

The following specimens were dredged by the Blake, 1877–80.

Station.	Fathoms.	Locality.	Specimens.
1877–78.			
29	955	N. Lat. 24° 36′, W. Long. 84° 5′	1
1878–79.			
256	370	Off Grenada	1
1880.			
V.	288	Off Santiago	1
VII.	610	N. Lat. 17° 28′ 30″, W. Long. 77° 30′	1
XVIII.	600	" 18° 20′ 30″, " 87° 16′ 40″	3

Acanella spiculosa Verrill, sp. nov.

Mode of branching unknown, except that the branches originate from the horny joints. Axis in the branches very slender; calcareous joints long, solid, white; horny joints very short, orange-yellow. Cœnenchyma composed of numerous large, more or less crooked, fusiform spicula. Calicles elongated, more or less cylindrical, usually somewhat enlarged at the summit and slightly swollen at the base; summit armed with eight large, rather stout, sharp, projecting spicula; sides of the calicles covered with similar large, fusiform spicula, mostly somewhat obliquely placed, and curved to correspond to the surface of the calicles; those at the bases of the calicles are usually larger and very crooked, intermingled with some of smaller size.

Length of the larger calicles, from 3.5 to 4.5 mm.; diameter, 1.25 mm.

Only a single specimen of this species has been seen, consisting of two small branches, one of which gives rise to a single small, lateral branchlet. It closely resembles *A. eburnea*, but is distinguished by the very much larger size of the spicula in the basal part of the calicles, and in the cœnenchyma.

Station 222, in 422 fathoms, off St. Lucia, Blake Expedition, 1878–79.

Acanella simplex Verrill, sp. nov.

Rather slender, apparently unbranched. Calcareous joints long, slender, distinctly sulcated, solid (in the several joints examined); horny joints short, dark brown.

Calicles numerous, prominent, rather long, cylindrical or enlarged distally, covered with stout, often curved, blunt or not very acute, finely warted, oblong or fusiform spicula, and armed at the margin by eight similar spicula of somewhat more elongated form, but less acute than in most other species. The base is supported by similar large, often much curved spicula. Similar large, fusiform spicula extend a little beyond the base of the calicles, in the thin cœnenchyma, becoming smaller away from the calicles; the cœnenchyma is often largely destitute of spicula between the calicles when rubbed; in many parts only a few scattered, small, oblong and fusiform, blunt, warted spicula are found, here and there, but in other places it is covered with smaller and larger oblong spicula, intermingled. Color in alcohol, yellowish brown.

Height of the largest example, 230 mm.; length of calicles, 5 mm.; diameter, 1.5 to 2 mm.; diameter of axis, 1 mm.

The following specimens were dredged by the Blake, 1878–80.

Station.	Fathoms.	Locality.	Specimens.
205	334	Off Martinique	1
288	399	Off Barbados	1

A specimen was also dredged by Mr. Pourtales, on the "Bache," March 4, 1869, first haul, in 450 fathoms.

Lepidisis Verrill, gen. nov.

Axis with long, tubular, calcareous joints alternating with short horny ones; simple or branched, the branches, when present, arising from the horny joints. Base divided into long, irregular, flat lobes. Cœnenchyma thin, with an external layer of small, oblong, scale-like spicula, sometimes with a few fusiform spicula beneath them, especially around the calicles.

The calicles are large and elongated; the margin is armed by about eight long, spiniform, projecting spicula, alternating with the tentacles; their sides are filled with large, fusiform spicula, which are more or less covered externally by small, oblong, scale-like ones, like those of the cœnenchyma. Tentacles filled with numerous, small, oblong, blunt spicula.

This genus is closely allied to *Acanella*, differing only in having the external layer of small scale-like spicula, both in the cœnenchyma and on the calicles.

Lepidisis caryophyllia Verrill, sp. nov.

Plate IV. Figs. 1, 1 a, 1 b, 1 c.

Two specimens are in the collection of 1880, both unbranched, but both are broken. One (see Plate IV. fig. 1), from Station 308, has the basal processes. The other, which is incomplete at both ends, is a simple stem over a foot (160 mm.) long, and about 1.5 to 2 mm. in diameter. The white calcareous joints, except near the base, are long (45 to 55 mm.) and hollow; the brown horny joints are short (1 to 2 mm.); the cœnenchyma is very thin, filled with small, oblong, blunt, flat or scale-like spicula, with some longer fusiform ones around the calicles, and a few scattered ones of the same kind. The calicles are few, distant, long (6 to 8 mm.), clavate, slender at base, enlarging toward the summit, which is expanded at the end (2.5 mm.), and armed usually with eight long and large spine-like or fusiform spicula, which project in a circle around the margin, and run back nearly the whole length of the calicles. These are intermixed with and surrounded by numerous smaller and more slender ones. The calcareous joints are rather strongly sulcated, especially toward the base, and have a rather large central cavity. The base is divided into root-like, irregular, flattened, crooked anchoring-lobes, much as in *Acanella Normani* and many other forms which inhabit soft muddy bottoms in deep water.

The spicula of the calicles are of several forms and of very diverse sizes. The largest (Fig. 1 b′, *d*, *e*) are long, often a little bent, rather slender spines, slightly thicker near the middle, with the inner end flattened and obtuse, and the outer end acute and nearly smooth toward the tip ; elsewhere the surface is covered with minute conical spinules, which are arranged in divergent, longitudinal rows, more conspicuous near the inner or obtuse end (Fig. 1 b). These large spicula vary much in size. Some of them measured 5.50 by .13, 5.10 by .25, 4.25 by .11, 3.75 by 10, 3.42 by .13, 3.25 by .15 mm.

With these are others, of smaller size and usually more slender, which are flattened, obtuse, and spinulated at both ends, or throughout; some of these are broader at the ends than in the middle, while others are of nearly uniform breadth; they are straight, or but little bent; and some are very slender; they vary greatly in size. Some of these measured 3.68 by .10, 2.00 by .06, 1.75 by .075, 1.10 by .08 mm. A few are slender and pointed at both ends; one of these was 2.50 by .05 mm.

There are also, from the polyps, some smaller, minutely spinulated, fusiform spicula (Fig. 1 b, *f*), acute at both ends (perhaps from the tentacles); and still smaller flattened, oblong spicula, obtuse and often enlarged at both ends, and longitudinally striated (Fig. 1 b, *g*, *h*, *i*). The latter come from the tentacles. The cœnenchyma is filled with small, oblong, flattened spicula (Fig. 1 c), which are often narrower in the middle than near the ends, which are obtusely rounded; the surface is finely striated or grooved and roughened longitudinally. Some of these measured .16 by .004, .16 by .003, .13 by .004, .13 by .003 mm. Around the calicles, and occasionally elsewhere, long, spiniform spicula, like the medium-sized ones of the calicles, are mixed with those characteristic of the cœnenchyma.

The following specimens were dredged by the Blake, 1878–80.

Station.	Fathoms.	Locality.	Specimens.
1878–79.			
161	583	Off Guadeloupe	1 broken.
1880.			
308	1242	N. Lat. 41° 24′ 45″, W. Long. 65° 35′ 30″	1 "
339	603	" 34° 39′ 40″, " 75° 14′ 40″	1 "

Lepidisis longiflora Verrill, sp. nov.

Plate IV. Figs. 4, 4 a.

A large and stout species, sparingly and distantly branched, the branches arising from the horny joints singly, or two at a time, and in that case usually opposite; the branches are ascending, usually straight or a little curved. The calcareous joints of the branches are rather long and moderately slender, swollen at the ends, distinctly and often strongly sulcated; they usually have a rather large central tube. Horny joints very short, brown. Calicles large, long, cylindrical or nearly so, often enlarged distally; the margin is armed with eight large, stout, spinous spicula, not projecting very far, the free part nearly smooth; below the margin the sides are supported by large fusiform spicula, somewhat obliquely placed, and the exterior is covered almost entirely by small, oblong, flat, scale-like spicula, blunt at the ends and often narrowed in the middle; their length is about three times their breadth (Plate IV. Fig. 4a, *b*, *c*).

The thin cœnenchyma is also composed mainly of these same scale-like forms, which entirely cover its surface in dry specimens. Some of these measured .46 by .13, .33 by .10, .30 by .11, .30 by .10, .28 by .09, .25 by .10, .25 by .09, .23 by .10, .20 by .07, .18 by .07, .18 by .06 mm. They are minutely roughened by longitudinal lines which diverge toward the ends, where the edges are finely denticulated or serrate; many of them are also denticulate along the sides.

The following specimens were dredged by the Blake, 1877–79.

Station.	Fathoms.	Locality.	Specimens.
1877.			
2	805	Off Morro Light	1
1878–79.			
131	580	" Santa Cruz	1
190	542	" Dominica	1
266	461	" Grenada	1

Lepidisis vitrea Verrill, sp. nov.

Mode of branching unknown. Axis slender; calcareous joints translucent, strongly fluted, and with a very large central tube, so large that the solid matter is reduced to a thin, fragile shell; horny joints short, pale yellow. Cœnenchyma very thin, with few, scattered, small, oblong or hour-glass-shaped spicula, and some fusiform ones. Calicles very much elongated, narrowed toward the base and expanded at the summit, which is armed with eight very sharp, much elongated, nearly smooth, glassy, fusiform spicula, which extend along the sides of the calicles nearly to the base. Other similar acute, fusiform spicula, mostly of smaller size, and only slightly roughened, cover the sides of the calicles; these are mostly straight and often extend the whole length of the calicles; with these are long, slender, oblong spicula, with both ends blunt.

Of this species only two fragments, without branches, have been seen. It is remarkable for the large size of the central tube of the axis, and also for the unusually long and sharp spicula that surround the summit of the calicles, as well as for the translucent and glassy appearance of both the spicula and axis. In the form of the calicles it most resembles *Lepidisis caryophyllia*.

Station 222, in 422 fathoms, off St. Lucia, Blake Expedition, 1878–79.

Family CHRYSOGORGIDÆ Verrill, nov.

Coral variously branched, the branches most commonly taking a spiral arrangement. Axis partially calcareous, generally with a brilliant iridescence and metallic lustre. Base, in most of the species where it has been observed, calcareous, and divided into irregular, divergent, root-like processes for anchoring in the mud, but in some species it is flattened and adherent to pebbles. Usually the hard, white calcareous base is sharply contrasted with the axis of the stem. The calicles are prominent, scattered along the branches, either standing at right angles or obliquely; they are covered with moderately large elongated or flat spicula, and are usually eight-lobed at the summit. Cœnenchyma very thin, with oblong or elongated spicula.

This family includes some of the most beautiful and interesting of all the known Gorgonians. These species are remarkable both for the elegance of the forms in which they grow, and for the brilliant lustre and opaline and iridescent colors of the axis, which in some species has the bright emerald-green lustre of the most brilliant tropical beetles, and in others is like burnished gold or polished mother-of-pearl.

The known species are all inhabitants of deep water, and all are from the West Indian seas, except *Dasygorgia Agassizii*, which occurs off the New England coast. The observed species can be referred to the following genera.

A. *Much branched, often spirally; the branches repeatedly forking.*

Chrysogorgia. Calicles elongated, often narrowed near the base, covered with rather long rough spicula, which are more or less transverse over the basal half, and curved to fit the surface. Spicula of the cœnenchyma elongated or fusiform, warted.

Dasygorgia. Calicles obliquely placed on the branches, swollen at base, covered with flat, oblong spicula, which are arranged longitudinally or obliquely. Spicula of the cœnenchyma oblong or scale-like, nearly smooth.

AA. *Axis forming a spiral or helix, with slender undivided branches, in a single spiral row.*

Iridogorgia. Calicles verruciform, with swollen bases extending along the branches, filled with slender elongated spicula, obliquely and transversely arranged. Spicula of the cœnenchyma similar. Surface of cœnenchyma with peculiar soft verrucæ.

Although but one species (*Dasygorgia Agassizii*) has been found on our coast north of Florida, I have included here some of the West Indian forms for the sake of comparison, and more fully to illustrate the characters of this hitherto imperfectly known group.

This family is related, in several respects, to Primnoidæ, especially to *Calligorgia* and allied genera, which are likewise chiefly found in deep water, and some of which have the axis similar in structure and lustre. In the latter group, however, the calicles are differently constructed, and the spicula become genuine scales. The sharp distinction between the calcareous base and the more horny stem, above, indicates, perhaps, some relationship with the Isidæ.

Dasygorgia Agassizii Verrill, sp. nov.

Plate II. Figs. 4, 4 a, 4 b.

Two specimens of this elegant species were taken off George's Bank, at Station 308, in 1,242 fathoms, N. Lat. 41° 24′ 45″, W. Long. 65° 35′ 30″.

The larger specimen, broken at both ends, is about 225 mm. high; the stem is about 2.5 mm. in diameter at base, while the slender side branchlets are 40 to 60 mm. long, and exceedingly slender and hair-like. Toward the base there were a few larger branches, only one of which remains. Along the main stem, which is a little bent in zigzag, the side branchlets are numerous and close, and spread nearly at right angles, ascending a little at their bases; they are arranged somewhat alternately, but form five rows along the stem, or, in other words, every sixth one lies in nearly the same vertical plane; the vertical distance between successive branches is about 2 mm., and between every sixth, in the same line, from 10 to 12 mm.

The branchlets are two or three times forked; the first fork is 3 to 4 mm. from the axil; each branch usually again divides 3 to 5 mm. from the first forking; after this the forking is unequal, some of the divisions remaining simple, others dividing; the ultimate branchlets are exceeding delicate and hair-like, and have a tendency to lie in horizontal planes. The axis of the main stem is round, not grooved, smooth and lustrous, with a bright, bronze-like lustre and light yellow color; that of the branchlets is pale amber-color, and translucent; the axis is largely horny, and can be easily cut with a knife, but it effervesces in acids. At the base the nature and color of the axis abruptly change, the basal expansion and root-like processes being ivory-white and stony. In our examples the base divides into several long, divergent, irregular, palmate, flattened processes, for anchoring the coral in the mud.

The calicles are few, prominent, oblique, rather distantly scattered along the sides of the branchlets, which they often exceed in diameter; they are mostly obliquely set, their summits being directed upward and outward, while the basal portion is larger, swollen, and more horizontal along the branchlets; the summit is conspicuously eight-lobed, and the tentacles are not entirely retractile, their bases showing as eight convergent, spiculose lobes; the sides of the calicles are covered with slender, oblong, flat spicula, which are mostly parallel with the calicle on the lower half, but near the bases of the tentacles become more or less oblique.

The spicula of the calicles (Fig. 4 b, *c*, *d*) are mostly small, flattened, slender, oblong, often with nearly parallel sides, but mostly narrower in the middle, bluntly rounded at the ends, the surfarce finely striated; some of these measured .18 by .05, .16 by .05, .16 by .04, .15 by .05, .13 by .04 mm. Toward the apex of the calicles and in the bases of the tentacles, there are many acute or obtuse fusiform spicula, often twice as long as the preceding, and equalling or exceeding them in breadth, and with the surface minutely spinulated. Some of these measured .34 by .04, .33 by .045, .32 by .04, .30 by .035, .25 by .03 mm.

The cœnenchyma is very thin and delicate, filled with minute, flat, oblong, obtuse spicula (Fig. 4 b, *e*), in form much like the first or commonest kind from the calicles, described above, but rather smaller.

The color of the calicles and cœnenchyma is pure white in alcohol.

Dasygorgia elegans VERRILL, sp. nov.

This species is closely allied to the preceding.

Coral tall, round, symmetrical, elegantly spirally branched, with the main stem bent in zigzag, and the branches arranged nearly as in *D. Agassizii*, but closer, shorter, and more numerously subdivided. The branchlets are shorter and less flexible, those from each branch are situated nearly in the same horizontal plane. The base consists of several rather long, divergent and descending, clear white, calcareous, more or less crooked, root-like lobes, some of which are forked. The axis of the main stem is light brownish yellow, and but little iridescent; that of the branchlets is pale yellowish white with slight iridescence.

The calicles are larger and stouter than in *D. Agassizii*, and set more nearly perpendicular to the branches. They are swollen at the base and summit, and terminate in eight distinct spiculose lobes. The sides are covered with stout, oblong, rather irregular, blunt, finely spinulated or warted spicula, which are decidedly larger, stouter, rougher, and less numerous than in *D. Agassizii.* The thin cœnenchyma is filled with smaller, oblong, finely spinulated spicula, larger and rougher than those of *D. Agassizii.*

Height, 160 mm.; breadth in middle, 45 mm.

Station 283, in 237 fathoms, off Barbados, 1878–79.

The following specimens were dredged by the Blake, 1878–79.

Station.	Fathoms.	Locality.	Specimens.
260	291	Off Grenada	1
283	237	" Barbados	2 typical.
284	347	" "	3 "

Dasygorgia spiculosa VERRILL, sp. nov.

Plate II. Fig. 5.

Coral larger and stouter, but spirally branched, as in the two preceding species. The branches are larger and longer, with fewer and less regular branchlets than in *D. elegans*, and they do not lie in horizontal planes; they diverge widely, at the successive forkings, and in different planes; the terminal ones are very slender. The main stem is rather stout and bent in zigzag at the origin of the branches; it is light brownish yellow, with little iridescence.

The base, which is present in one example, is calcareous, and spreads out widely and irregularly over a fragment of dead coral. The calicles are larger than in either of the two preceding species; they mostly stand at nearly right angles to the branches, but those near the tips are oblique; they are constricted somewhat above the swollen base, but enlarged and eight-lobed at the summit. The sides of the calicles are covered with unusually large, fusiform and oblong, finely warted spicula, longitudinally and obliquely arranged; at their bases, and in the cœnenchyma near their bases, are longer and thicker fusiform spicula, usually acute and finely warted or spinulated; near and around the bases of the terminal calicles (Fig. 5) these often become remarkably large. The cœnenchyma elsewhere on the branches is filled with much elongated, slender, acute, fusiform spicula of the same character, but smaller; on the main stem, near the base, they are much smaller, short, oblong, blunt, and roughly warted.

Height, 210 mm.; breadth, 60 mm.

The following specimens were dredged by the Blake, 1877–79.

Station.	Fathoms.	Locality.	Specimens.
1877–78.			
44	539	N. Lat. 25° 33′, W. Long. 84° 35′	3 good, with bases.
1878–79.			
190	542	Off Dominica	1 and fragments.
195	502½	" Martinique	3 typical.
205	334	" "	1 "
222	422	" St. Lucia	Fragments.
227	573	" St. Vincent	1

Dasygorgia squamata Verrill, sp. nov.

Coral spirally branched, nearly as in the preceding species, with which it agrees nearly in size and appearance.

The axis is yellowish or amber-colored, with a pale iridescence. The calicles are large, about the same in size and shape as those of *D. squamosa*, and mostly stand nearly at right angles to the branch. They are decidedly enlarged at the summit, and are unusually smooth, owing to the nature of the spicula, which are rather large, flat and smooth, scale-like, oval, oblong, or irregular in shape, and so closely imbricated and fitted together as to resemble a coat of mail, giving the surface of the calicles a smooth appearance under the microscope; these flat spicula are iridescent; near the summit and on the eight lobes, at the bases of the tentacles the spicula become smaller, narrower, and oblong. The cœnenchyma is filled with smaller, smoothish, flat, oblong and irregular, scale-like spicula, which become larger and more scale-like near the calicles.

The following specimens were dredged by the Blake, 1878–79.

Station.	Fathoms.	Locality.	Specimens.
227	573	Off St. Vincent	1
283	237	" Barbados	2

Dasygorgia splendens Verrill, sp. nov.

Coral slender, spirally branched, much as in *D. spiculosa* and *D. Agassizii*, but it apparently has a lower and more bushy growth. Main stem rather stout, bent in zigzag ; distance between branches usually 5 to 8 mm. Axis polished, with a very brilliant metallic iridescence, in which deep emerald-green and blue tints predominate ; in the branches the axis is amber-colored, with less iridescence. Cœnenchyma thin, with small fusiform spicula. The calicles are distant, rather stouter than in most species of the genus, but perhaps a little shorter than in *D. spiculosa;* they mostly stand a little obliquely ascending on the branches, and are much broader than the smaller ones; they are nearly cylindrical, or only a little constricted above the base, which is a little expanded; summit prominently eight-lobed. The calicles are thickly covered with rather large, oblong, blunt, thickened, smoothish, iridescent spicula, which rise up distinctly above the surface and are not closely imbricated; they lie nearly longitudinally on the sides, but obliquely at the base, where the largest ones are situated. The spicula of the cœnenchyma are smaller, flattened, oblong and fusiform, often with indented edges, but with a smooth, lustrous, iridescent surface.

Off Santa Cruz, Stations 124 and 131, in 580 fathoms, Blake Expedition, 1878–79.

Chrysogorgia Desbonni Duch. & Mich.

Duchassaing & Michelotti, Supplément Mém. Corall. des Antilles, pp. 13, 21, pl. 1, figs. 7, 8, pl. 4, fig. 5.

Plate II. Figs. 6, 6 a, 6 b.

Coral flabellate, sometimes with the branches all in one plane, in other cases dividing near the base into two or more principal branches, which stand parallel and take a fan-shaped form. The main branches divide repeatedly into smaller branches by successively forking. The branchlets are divergent, and the forks are from 3 to 6 mm. apart. The terminal branchlets are small, short, and somewhat rigid. The axis is rather hard, rigid, somewhat calcareous, in the main stem and larger branches dark brown or brownish black, in the smaller branchlets yellowish brown, translucent. Cœnenchyma thin, white in alcholic specimens, and composed of irregular, oblong and fusiform, roughly warted spicula (Figs. 6 a, 6 b). Calicles scattered, often secund, prominent, more or less enlarged at the summit; they stand at right angles to the branches, or even turn somewhat downward. The calicles (Fig. 6) are covered with rather large, elongated, roughly warted, curved spicula, arranged transversely, the curvature of the spicula corresponding to the surface of the calicles; summit of the calicles strongly eight-lobed, the lobes corresponding to the bases of the tentacles, and filled with smaller spicula.

Height of ordinary specimens, 65 to 80 mm.; breadth, 60 to 70 mm.

Taken at numerous localities in the Caribbean Sea and among the Antilles, in 88 to 163 fathoms, by the Blake, in 1878–79, and off Cuba, in 288 fathoms, in 1880.

Chrysogorgia Fewkesii Verrill, sp. nov.

Chrysogorgia Desbonni Pourtalès, 1868 (*non* Duch. & Mich.).

Coral tall, spirally branched, nearly as in *Dasygorgia Agassizii* and *D. spiculosa*, but larger and stouter, with thicker and more numerously divided branches; stem strongly bent in zigzag; the main branches diverge, on all sides, nearly at right angles, one arising from the outer side of each angle; distance between the branches from 4 to 6 mm. The branches fork repeatedly, the first division being usually about 10 to 12 mm. from the main stem; subsequent divisions are at unequal distances, the final branchlets numerous, very small, and spreading widely. Axis smooth, hard, brownish yellow or amber-colored in the stem and larger branches, and with only a slight iridescence; pale yellow, translucent, very slender, in the smaller branches. Cœnenchyma thin, white in alcoholic specimens, composed of large, fusiform, warty spicula, arranged lĕngthwise of the branches. Calicles irregularly scattered, rather small, prominent, usually constricted below the middle, with the summit and base enlarged; they mostly stand nearly at right angles to the branches, those near the tips obliquely ascending. Surface of the calicles covered with large, stout, warty, curved spicula, which are arranged obliquely and transversely toward the base, and mostly transversely in the middle portion; summit of the calicles strongly eight-lobed, the lobes filled with smaller, stout, blunt spicula. Height of one of the largest examples, 170 mm.; breadth, 110 mm.

Station 227, in 573 fathoms, off St. Vincent, W. I., Blake Expedition, 1878–79. Several specimens. Also from several other localities in the same region, and off Cuba.

This species is dedicated to Mr. J. W. Fewkes, of the Museum of Comparative Zoölogy.

Iridogorgia Verrill, gen. nov.

Axis partially calcareous, with a brilliant iridescence; in the only known species it grows in the form of an upright spiral, or helix, from which a single series of long, slender, simple branches is given off on the outer side, so that they likewise have a spiral arrangement.

Calicles scattered along the branchlets, far apart, verruciform, with a swollen base, elongated in the direction of the branch, filled with slender fusiform spicula. Tentacles large, not retracted in the alcoholic examples, and not stiffened by spicula. Cœnenchyma very thin on the branchlets, containing slender fusiform spicula; on the stem and basal portion of the branches covered with small, prominent, rounded, soft verrucæ, having the outer surface composed of a layer of special nettling cells; these verrucæ also extend over the basal part of the lower calicles. They may, perhaps, be of the same nature as the zoöids of Pennatulacea.

Iridogorgia Pourtalesii Verrill, sp. nov.

Plate II. Figs. 7, 7 a.

Main stem strong, rather rigid, calcareous, growing in a remarkably regular, open, upright spiral or helix. Base not obtained. Branches numerous, long, slender, delicately tapered, flexible, undivided; they arise very regularly, at intervals of about 4 to 6 mm., in a single row, along the side of the main stem that forms the outside of the spiral, and spread out laterally and widely, nearly at right angles to the stem, so that the whole coral has a broad spiral form, something like the skeleton of a spiral staircase.

The axis, in our example, makes about five volutions; its apex becomes slender and acute, but the lower end is incomplete.

The cœnenchyma is thin, and filled with slender fusiform spicula beneath the surface, which is soft, and bears numerous minute, rounded, elevated, soft verrucæ, which cover the main stem and proximal part of the branches, extending also over the basal portion of their proximal calicles, but they gradually become smaller and disappear farther out on the branches.

Calicles are not found on the main stem, except rarely one close to the origin of a branch; on the branches they are placed singly, and rather far apart, along the upper side; the distance between them is usually from 5 to 10 mm. The calicles are mostly broader than the branches on which they are situated; they have a swollen basal part, extending somewhat along the branch; the upper part is verruciform, and is usually surmounted by the large, incurved tentacles, which do not appear to be capable of entire retraction. The proximal calicles (Fig. 7) are the largest, and have very large tentacles, with swollen translucent stems, in which there are only a few slender spicula, close to the base; the pinnæ are elongated, slender, and without spicula. The calicles are filled with slender, nearly smooth, acute spicula, oblique and transverse in the basal portion, but becoming longitudial at the summit, between the bases of the tentacles.

In alcohol, the color of the calicles, tentacles, and cœnenchyma is white; the denuded axis and branches have a bright golden or pale bronze-like lustre, and reflect brilliant iridescent colors, in which light green and golden yellow predominate; by transmitted light the axis of the branches is pale wax-yellow and light amber.

Height of main stem, 200 mm.; diameter at lower end, about 2 mm.; diameter of larger branches, at base, 1 mm. or less. The larger, upright, fusiform spicula in the distal part of the calicles measure .56 by 04, .48 by .04, .46 by .05, .42 by .04 mm.; those of the basal part of the calicles, .55 by .05, .55 by .04, .52 by .05, .50 by .04, .42 by .035, .42 by .025, .28 by .03,

.28 by .02, .24 by .03, .18 by .02 mm.; those of the cœnenchyma, .50 by .02, .38 by .015, .22 by .015 mm.

Station 190, in 542 fathoms, off Dominica, and Station 173, in 734 fathoms, off Guadeloupe, 1878–79, Blake Expedition.

Family PRIMNOIDÆ (emended).

Primnoadæ (*pars*) GRAY, Proc. Zoöl. Soc. London, 1857, p. 285; 1859, p. 483.

Primnoidæ (*pars*) VERRILL, Revision Polyps E. Coast N. Am., in Mem. Bost. Soc. Nat. Hist., I., 1864, p. 8; Trans. Conn. Acad., I., 1869, p. 418.

Primnoadæ (*pars*) + *Calyptrophoradæ* + *Calligorgiadæ* (*pars*) GRAY, Cat. Lithophytes Brit. Mus., 1870.

Primnoadæ (subfamily) STUDER, Monatsb. Akad. Berlin, for 1878, p. 641, 1879.

This family should, properly, be separated from *Muriceidæ*, and restricted so as to include only those genera in which the spicula of the cœnenchyma and calicles are scale-like and the axis more or less calcareous, at least in the main stem. The calicles are usually elongated and pedunculated, or narrower at base than at summit; they are frequently closed at the summit by eight opercular scales. In most of the species the calicles are arranged in whorls, which are often closely crowded, but in some cases they are in two simple, alternating rows. The *Muriceidæ* differ in having the axis entirely horny, and in having large fusiform or spiniform spicula. Gray erroneously included in his Primnoadæ *Swiftia* and *Thesea*, which have the axis horny and the spicula not scale-like; *Riisea*, which is closely allied to *Verrucella* and *Gorgonella*; and *Chrysogorgia*, the type of a distinct family. In his *Calligorgiadæ* he erroneously included *Scirpearia*, *Nicella*, and *Raynerella*, which are closely allied to *Verrucella*. There is no good reason for separating the three groups named by him.

Primnoa Pourtalesii VERRILL, sp. nov.

Plate II. Figs. 2, 2 a - 2 e.

The coral is plumose, with regularly pinnate branchlets, all in one plane. Near the base there are several divergent branches, like the main stem. The stem is compressed in the same plane with the branches, and is a little bent in zigzag between the branchlets. The branchlets are very regular, slender, straight and nearly parallel, alternating on the two sides, and diverging at an angle of about 45° from the stem. They bear the calicles in two close, regular, alternating rows. The calicles are elongated, expanded at the summit, and curve a little upward and forward, so that the openings all face the front side of the coral; they are elegantly clad in a covering of small imbricated scales, forming several rows, and the aperture is closed by eight regular, convergent, triangular scales. Along each side of the main branches there is also a row of similar calicles, usually two on each side, between the bases of successive branchlets.

A very small specimen, 24 mm. high, attached to a pebble, has a small conical base; it has already given off four small, unequal branches; the calicles are like those of the more mature examples, but smaller.

The color, in alcoholic specimens, is white; axis light yellow.

The largest specimen, without its base, is 120 mm. high, 75 mm. broad.

The scales of the calicles (Figs. 2 b, 2 c) are thin and of various forms, roundish, oval, or more or less angular, usually with finely serrate margins; they have a prominent nuclear point, near the proximal edge, from which structural lines radiate; the outer surface is covered with small, prominent, unequal, sharp warts and spinules, sometimes taking the form of thin, elevated, radial crests; the spinules are crowded in the central area, becoming more scattered toward the distal margin; they usually appear to be irregularly arranged, but radial rows can often be distinguished. Some of these scales measured .31 by .28, .30 by .18, .29 by .25, .25 by .22 mm. The opercular scales (Fig. 2 d) have the form of an isosceles triangle, with the distal end acute and the basal angles rounded; the raised nuclear point is near the broader end, and from it rows of warts, spinules, and small crests run, radially, toward the margins, but usually leave the distal and somewhat of the lateral edges bare; the spinules are largest on the distal rows, and are strongly inclined toward that end of the scale; the margins are finely serrulate. Two of them measured .34 by .20, and .33 by .16 mm. The scales of the cœnenchyma (Fig. 2 e) are similar to the lateral scales of the calicles, but smaller and more rounded, with a more central nucleus. They vary considerably in size and form, and are mostly covered with rough, unequal warts and spinules, arranged more or less distinctly in radial rows. Some of these measured .25 by .16, .25 by .15, .24 by .13, .20 by .15, .20 by .13, .18 by .14, .18 by .11, .17 by .15, .16 by .12, .16 by .11 mm.

Two good specimens of this species, with several fragments, were taken at Station 318, in 337 fathoms, N. Lat. 31° 48′ 50″, W. Long. 77° 51′ 50″.

Family GORGONIDÆ.

Stenogorgia, gen nov.

Axis horny, branched. Cœnenchyma thin, consisting chiefly of small, warty, fusiform spicula, with a few smaller, short, irregular, rough, granule-like spicula next the outer surface, but not forming any regular layer. Calicles scattered or two-rowed, more or less prominent, eight-rayed at summit, and filled with spicula, like those of the cœnenchyma. Tentacles filled with fusiform spicula and usually incurved, commonly not retracted within the calicles, but capable of it.

This genus externally resembles *Thesea* and *Eunicella*, but in the former the cœnenchyma has a superficial layer of scales, and in the latter it has a regular external covering of club-shaped spicula, standing perpendicular to the axis. In *Swiftia*, which has a similar appearance, the cœnenchyma consists of small scales only. Its affinities are, apparently, with *Leptogorgia*.

Stenogorgia casta Verrill, sp. nov.

Plate II. Figs. 1, 1 a, 1 b.

A small, delicate coral, pure white in alcohol, with rather prominent calicles, in two alternating rows. The base is expanded and adherent. The main stem divides dichotomously from near the base. The branches fork irregularly and unequally, or sometimes branch somewhat pinnately and sparingly. The branches and branchlets spread outward at a wide angle, and then curve upward; they lie nearly in one plane, and do not differ much in size, the terminal ones often being the largest. The axis is nearly round, chestnut-brown in the larger branches, pale yellowish in the terminal ones. The calicles are prominent verruciform, or broad-conical, and form a close row along each edge of the branches, but those in one row do not lie precisely in a plane, for they alternately face a little to the front and to the rear; those on opposite margins of the branches alternate, and as the swollen bases of the calicles are in contact the edges of the branches show a zigzag outline; the calicles are narrow at the summit, in the preserved specimens, and are closed by eight convergent segments, and in most cases they are surmounted by a small round cluster of incurved tentacles, which show their outer surfaces filled with convergent spicula.

The largest specimen is 100 mm. high, and 120 mm. broad; diameter of the branches, including calicles, 2.5 to 3 mm.

The spicula of the cœnenchyma and calicles are rather small, fusiform, often bent, irregularly covered with more or less numerous prominent warts; some of these spicula are elongated and acute at both ends; others are stouter and more obtuse; the longer spicula measure .32 by .06, .28 by .05, .28 by .045, .23 by .05, .20 by .05, .16 by .03 mm.; the stouter ones, .21 by .06, .20 by .07, .17 by .06, .15 by .06, .11 by .045 mm. In the tentacles there are numerous slender, mostly bent and sparingly warted or spinulated spicula, acute at one or both ends, with some that are larger, blunt, and roughly warted at one end, and others roughly warted all over; flattened oblong spicula, some of them with roughly warted borders, also occur. The slender, smoothish spindles of the tentacles measured were .23 by .02, and .19 by .015 mm.; the stouter and rougher ones, .26 by .05, .26 by .03, .19 by .04, .16 by .03, .14 by .03 mm.; the flattened oblong ones, .10 by .05, and .10 by .04 mm.

Station 318, in 337 fathoms, N. Lat. 31° 48′ 50″, W. Long. 77° 51′ 50″, 1880.

Family MURICEIDÆ.

Acanthogorgia Gray.

Proc. Zoöl. Soc. London, for 1857, p. 128.

Blepharogorgia Duch. & Mich., Supplément Mém. Corall. des Antilles, in Mém. Turin Acad., XXIII., 1864–66, p. 109.

Coral variously branched, usually slender and flexible. Cœnenchyma thin, filled with fusiform spicula, sometimes having one end projecting as spinules from the surface. Calicles elongated, tubular, often expanded at the end, and armed with eight long, projecting, spiniform spicula, or clusters of spicula, which are enlarged and bent at the base, but not lamelliform; sides of the calicles usually eight-ribbed, and covered with fusiform spicula.

This genus has been more or less confounded with *Paramuricea* by several authors. To that genus it is closely allied, differing chiefly in the longer calicles and their longer marginal spines, and in having slender fusiform spicula without the irregular, flat, branched forms, characteristic of *Paramuricea.*

Besides the species herein described, this genus includes *Acanthogorgia hirsuta* Gray, the type of the genus, recorded by Johnson from off Madeira, and *A. Schramii* (Duch. & Mich. sp.) from the West Indies. Other species wrongly referred to the genus by Johnson and Pourtalès are mentioned under *Paramuricea.*

Acanthogorgia armata Verrill.

Acanthogorgia armata Verrill, Amer. Jour. Sci., XVI., 1878, p. 376; XXIV., 1882, p. 364.

Plate III. Figs. 1, 1 a, 1 b, 2, 2 a, 2 b.

Coral slender, flexible, much and irregularly branched, bushy and shrub-like, often with the branches somewhat in a plane, and occasionally uniting. Cœnenchyma thin, filled with rather small, white, often curved, warted, fusiform spicula, which do not project from the surface in spine-like points. Calicles usually very much elongated, the length often six to eight times the diameter, clavate, or capitate, smallest near the base and suddenly enlarged near the summit, which is surmounted by eight groups of long, divergent, sharp, spine-like spicula, with their projecting points nearly smooth; sides of calicles with eight low ridges or angles covered with elongated, warty spicula, having an irregular, chevroned arrangement, but usually not projecting from the surface as spines, or but slightly so.

In a few cases marked variations have occurred in the form of the calicles on different branches of the same specimen (see Figs. 1, 1 a, 1 b). In these cases, on part of the branches they are of normal shape and size (Fig. 1), while on other branches they may be much shorter, cylindrical, or even swollen in the middle and not enlarged at the end (Fig. 1 b); but on still other branches they may have intermediate forms (Fig. 1 a). On the specimen from which these figures were made the calicles were rougher or more spinose along the sides than usual.

Height of one of the original examples, 200 mm. (about 8 inches); breadth, 150 mm. (about 6 inches); length of calicles, 5 to 8 mm.; their diameter at base, .8 to 1 mm.; at summit, 1 to 1.5 mm. Much larger examples have since been obtained, some of them 1500 mm. (about 20 inches) high, and half as broad.

The specimens of this species brought from the fishing banks off Nova Scotia and Newfoundland by the Gloucester fishermen vary considerably in the mode of branching. The largest specimen from the Grand Banks is eighteen inches high and twelve broad. It has a rudely fan-shaped form, the branches being nearly in one plane, but the terminal branchlets are very unequal in length, crooked and flexible ; they are so numerous and so irregular in their origin and direction as to produce a bushy appearance. Five large main branches arise near together, close to the base ; these are 5 to 8 mm. in diameter ; some of them fork again, beyond the middle ; the divisions that they give off are large and small, strongly divergent or divaricate lateral branches or pinnæ, which divide and subdivide in the same way ; besides these there are many small, irregular, crooked and slender branchlets, 25 to 50 mm. (1 to 2 inches) in length, which are mostly unbranched, but bear long, slender, divaricate calicles, less close than those of the branches. Calicles also spring directly from the main branches, and still more numerously from the secondary ones, and on all sides of them.

In a smaller specimen, from lot 804, there are nine large branches and three smaller ones springing from the base.

In a small specimen, from lot 791, there are two primary branches from the base. In this the calicles are short and hardly pedunculate, except in certain parts, where they are somewhat so.

In one from lot 866, the branches and calicles are unusually slender.

In a specimen from lot 808, there is but a single main stem, and the branching is more irregular and bush-like. In this the calicles are shorter, thicker, scarcely pedunculated, and rather closely crowded on the terminal branchlets, while on other branches they are nearly as long as on the ordinary or more typical specimens. (Plate III. Figs. 1–1 b.)

In another example, from lot 364, the main stem divides once near the base, and the coral is shrub-like, not branching in a plane ; the branches are slender, widely divergent, crooked. The calicles are scattered, slender and pedicelled.

In life, the color is bright salmon ; when dried, it is usually ash-gray ; in alcohol, dark gray or ash-brown.

The larger spicula of the calicles (Fig. 2 b, *c*, *d*, *e*) are varied in form and size, mostly long, rather slender, some straight, others crooked, often bent abruptly in the middle, or toward one end ; they are strongly spinulated, except near the outer end, which is usually slender and very sharp ; the inner end is stouter, more or less blunt, sometimes irregularly slightly bilobed, and usually sharply spinulated, but not branched. Some of them are strongly spinulated throughout ; others, for less than half their length (Fig. 2 b, *c*) ; these are usually angularly bent near the middle ; the blunt and spinulated end is imbedded, and the smoother, sharper, and acute end projects from the surface, near the summit of the calicle. Some of the largest of these measured 1.62 by .10, 1.05 by .10, 1.00 by .07 mm. ; the straight ones, 1.52 by .10, 1.32 by .06, .99 by .10 mm. With these were smaller, more or less crooked, slender, fusiform spicula, strongly and sharply spinulated over the whole surface (Fig. 2 b, *g*). Some of these measured 1.52 by .10, 1.52 by .07, 1.28 by .07, .90 by .05 mm.

In the flexible part of the polyps and the bases of the tentacles there is an abundance of long, fusiform, more or less curved, and strongly spinulated spicula, mostly acute at both ends, and moderately slender, but some of them are much stouter in form, and many are enlarged, flattened, and somewhat lacerately spinulated at one end ; some compound forms also occur, but these also take an irregularly fusiform shape. Some of the curved ones, surrounding the polyp-body, measured .86 by .05, .86 by .038, 76 by .07 mm. ; the straighter ones, .80 by .10, .80 by .07, .76 by .07, .71 by .07, .70 by .05, .62 by .05, .62 by .038 mm.

Three specimens, of moderate size, and partly overgrown by sponges, were taken by the Blake, at station 309, off Nantucket, in 304 fathoms. To these were also attached *Astrochele Lymani ; Ophiacantha ; Pecten vitreus ;* a handsome *Scalpellum* ; and the fresh eggs of a black dog-fish (*Scyllium*). Another example, from station 306, in 524 fathoms, had similar things attached.

It was dredged by the U. S. Fish Commission, in 1882, off Martha's Vineyard, in 640 fathoms.

Several fine specimens have been brought from the deep fishing banks off Nova Scotia and Newfoundland by the Gloucester fishermen, during the past four years, and presented to the U. S. Fish Commission.

The first specimen was taken off Nova Scotia, in 300 fathoms, by Captain T. Goodwin (schooner "Elisha Crowell"). The second specimen was obtained off George's Bank, in about 220 fathoms, by Captain Anderson and crew of the schooner "Alice G. Wonson."

The following specimens were dredged by the Blake in 1880 : —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
306	524	41° 32′ 50″	65° 55′	1 medium.
309	304	40° 11′ 40″	68° 22′	3 "

The typical species of this genus, *A. hirsuta* Gray, was obtained in deep water, off Madeira. It is closely related to *A. armata*.

Two species closely allied to these were dredged in deep water, in the West Indian seas, by the Blake, in 1878–79. One of these, *A. aspera*, was described by Pourtalès, in 1867.

Acanthogorgia aspera Pourtalès.

Acanthogorgia aspera Pourtalès, Bulletin Mus. Comp. Zoöl., I., 1867, p. 113.

The original specimen of this species, described by Pourtalès, is small and slender, and probably young ; several unequal, widely divergent branches are given off laterally from the main stem, which also bears isolated calicles along the edges between the branches ; some of the branches begin to divide in the same manner. Axis brownish yellow. Cœnenchyma thin, filled with acute fusiform spicula, mostly with one end turned outward and projecting from the surface of the cœnenchyma in the form of slender, sharp points or spinules, giving the surface a very rough appearance. Calicles elongated, relatively large, mostly slightly constricted toward the summit, which is considerably enlarged and armed by numerous slender, very sharp, divergent spicula, which form eight clusters. Sides of the calicles with eight ribs, and covered with long, slender, very acute spicula, many of which have the sharp tips projecting from the surface, especially toward the base and along the ribs.

Height, 55 mm. ; breadth, about 25 mm. ; length of the larger calicles, about 3 mm. ; diameter, about 1 mm.

Taken off Havana, in 270 fathoms, by the "Bache," in 1867.

Acanthogorgia muricata VERRILL, sp. nov.

Coral moderately slender, flabellate. The stem usually divides, not far from the base, into several principal branches, which diverge widely at first and then ascend nearly vertically; these give off numerous lateral branches, which often diverge nearly at right angles, many of them again subdividing in a similar manner. Axis yellowish brown, strongly striated. Cœnenchyma thin, grayish white in alcoholic specimens, and having a loose granulous appearance, composed of small, rough, irregular, and rather large, very roughly warted or spinulose fusiform spicula ; many of the latter are crooked and are placed at all angles, but do not have projecting ends. The calicles are elongated, cylindrical, or somewhat expanded at the summit, and armed by about eight very long slender, sharp, projecting, and divergent spicula, the projecting part being usually more than two thirds the length of the calicle. Sides of the calicles covered with rather slender, elongated, warty, fusiform spicula, many of which are strongly curved ; and these are arranged so as to form eight longitudinal ridges ; the ends of some of the spicula frequently project from the surface, toward the summit.

Height of an ordinary specimen, about 175 mm. ; breadth, about 100 mm. ; length of the calicles, mostly about 3 mm. ; diameter, 1 mm.

Taken at station 272, in 76 fathoms, off Barbados, by the Blake, in 1878–79, and in several other localities in the same region.

This species is closely related to *Acanthogorgia armata*, but is more slender and has smaller and less prominent calicles, which are armed with longer and more acute spicula. The spicula of the cœnenchyma are also different in form. It differs from *A. aspera* in not having the calicles and cœnenchyma hispid with slender spines.

Paramuricea KÖLLIKER.

Icones Histiol., I., 1865, p. 136. (Type, *P. placomus.*)

Coral variously branched, often large. Cœnenchyma usually thick, filled with rough, fusiform, oblong, and irregular spicula, some of which often project from the surface as small spinules. Calicles short-cylindrical or verruciform, armed at summit by a circle of short projecting spinules, which are formed by the distal ends of large spicula having a large, irregular, flattened, usually lobed or branched basal portion ; sides of calicles with rough spicula, part of them irregular and flattened. Bases of contracted tentacles form eight triangular, convergent lobes, filled with spicula arranged in chevron ; a circle of curved transverse spicula surround the bases of these tentacular lobes.

This genus is a very characteristic one, in somewhat deep water, in all parts of the North Atlantic and in the Mediterranean. A large number of specimens, belonging to several species, were taken by the Blake in the Caribbean Sea and Gulf of Mexico, in 1877–79. Some of these are allied to our Northern forms, and are therefore included here. Some of the species that have formerly been referred to *Acanthogorgia* belong properly to *Paramuricea*. Among these are the following : —

Paramuricca Grayi (Johnson sp., 1861). Off Madeira.
Paramuricea Atlantica (Johnson sp., 1862). Off Madeira.
Paramuricea hirta (Pourtalès sp., 1867). Off Cuba.

Paramuricea borealis Verrill.

Paramuricea borealis Verrill, Amer. Jour. Sci., XVI., 1878, p. 213 ; XXIV., 1882, p. 364.

Plate III. Figs. 4, 5, 5a.

The original specimen of this species was small, with a low, bushy growth. Subsequently a considerable number of examples have been obtained, of larger size and taller growth, but agreeing in the form and arrangement of the calicles, and in the spicula.

When well developed this species grows in a somewhat flabellate form, the branches several times forking and having a tendency to lie in one plane. The larger branches diverge rather abruptly at their origin, and then ascend in a curve ; the smaller branches and branchlets are widely divergent, or divaricate, often spreading at right angles. The branches are rather distant, not very numerous, often crooked, and decidedly slender in most specimens, but in a few examples they are stouter than usual, and not unfrequently they are larger near the tips and have the calicles more numerous there, while over the branches generally they are usually distant, leaving much of the cœnenchyma bare. Occasionally they are closer than usual over most of the branches, giving them a stouter appearance.

The calicles (Fig. 5) are short, stout, cylindrical verrucæ, about as broad as high, crowned by a marginal circle of about eight short but acute spines, with a few other similar ones around the upper part, below the margin, but not extending far down the sides, so that the lower part of the calicles is not spinose, or only very slightly so. The calicles are composed of variously shaped, irregular, rough-edged spicula, mostly rather small, below the marginal spines.

Within the margin there are several transverse or circular rows of long, slender, pretty regularly curved, or bow-shaped, warty spicula, which surround the upper or marginal part of the partially retracted polyps, at the bases of the tentacles, which are themselves strengthened externally by two convergent rows of similar, but less curved spicula, so arranged as to form eight convergent Λ -shaped groups over the contracted and incurved tentacles.

The cœnenchyma is thin, not at all spinose, and filled with small, very irregular, rough spicula, many of which are crooked ; these spicula give the surface a rather finely and roughly granulous appearance under a lens. The axis is slender, soft and dark brown, and shrinks much when dried.

In life the color is light orange or salmon. In alcohol it becomes dark grayish brown or umber-brown. When dried the color is often dark brown or nearly black.

One of the larger specimens is 280 mm. (about 11 inches) high ; breadth, 90 mm. ; diameter of main stem, 3 mm. ; of branchlets, 1 to 1.5 mm. ; of calicles, 1 mm. The variety with stouter branches has branchlets 2 to 4 mm. in diameter, including the calicles.

The large spicula around the edge of the calicles (Fig. 5 a, *c*, *d*, *e*) have a large, broad, flat, variously and deeply lacerately lobed and incised, imbedded basal portion, and a rather short, moderately stout, acute, somewhat rough or warty terminal portion, which projects from the surface. The basal portion is frequently longer than the point, and often broader than long ; it is palmately divided into three to six, or more, irregular main divisions, which are very unequal in size and breadth, and variously subdivided and lobed ; some of the lobes may be broad, and others narrow, some acute, and others truncated or obtuse, and not unfrequently they coalesce, enclosing irregular openings. Some of these spicula measure 1.14 by .57, .95 by .38, .84 by .61, .82 by .48, .76 by .66, .76 by .32, .66 by .28, .61 by .32, .57 by .48, .57 by .32 mm.

With these are other smaller, rudely oblong, flat spicules (Fig. 5 a, *g*), which have no projecting point, or only a very short one, but are rudely and strongly lobed, along the sides and at one or both ends, the lobes being more or less sharp, rough and incised. These are variable in size ; some are .76 by .38, .52 by .34, 50 by .16 mm.

Just inside the margin of the calicles there are several transverse or circular rows of long, slender, roughly warted spicules (Fig. 5 a, *f*), tapering and acute at both ends, and curved in the middle ; these form a continuous band or ring around the base of the free part of the polyps. The larger of these measure 1.28 by .06, 1.05 by .095, 1.05 by .06, .82 by .07, .82 by .05 mm. Above these there are eight convergent, triangular or Λ -shaped groups of similar long, fusiform, warty, mostly crooked spicules, but they are not so strongly nor so regularly curved, the bend being usually nearer the proximal end ; these correspond with the stems of the eight tentacles ; some of them are divided at the base into two lobes or rough branches. The larger of these measure 1.24 by .07, 1.08 by .08, 1.01 by .07, .95 by .07, .86 by .08 mm. ; one of the long ones with forked base is 1.05 by .06 mm.

The cœnenchyma is composed mainly of smaller, rudely warted and spinulated, irregular, more or less fusiform, and often crooked spicules, varying much in size and shape (Fig. 5 a, *i–l*). Some measured .76 by .14, .57 by .10, .57 by .08, .55 by .10, .44 by .05, .38 by .14, .28 by .14 mm. With these are some that are forked or bilobed (.63 by .24, .52 by .24 mm.), and a few compound ones, all roughly warted.

This species was dredged off Martha's Vineyard by the U. S. Fish Commission, in 1882, in 234 fathoms. A number of specimens have been obtained by the Gloucester fishermen, from the fishing banks off Nova Scotia, and from the Grand Banks, in deep water. The original example was from the Grand Banks, with *Primnoa reseda.*

Paramuricea grandis Verrill, sp. nov.

Plate III. Figs. 3, 3 a, 3 b.

This is a large, stout, subflabellate species, growing to the height of two feet or more, with the main branches often half an inch or more in diameter. The branches fork several times, diverging widely at the axils, and then ascending, and having a tendency to lie nearly in one plane.

The branches are much stouter and the calicles more numerous than in *P. borealis;* they are usually nearly in contact at their bases, leaving very little of the cœnenchyma exposed, and are seldom separated by spaces equal to their diameters. The calicles form prominent verrucæ, swollen at the base, and scarcely as high as broad; the margin is crowned by eight slight, angular denticles, from which the small marginal spines scarcely project in alcoholic specimens, and only slightly in dry ones; the sides of the calicles are nearly smooth except near the margin.

In alcoholic specimens the whole surface of the calicles and cœnenchyma is covered with a nearly smooth soft dark brown skin, concealing the spicula. The polyps are capable of being entirely retracted within the calicles. Many are, however, only partially retracted, and show the circular series of slender bow-shaped spicula around the polyps and the convergent groups of slender curved spicula on the tentacles, as in *P. borealis*, but they are smaller in this, and not at all spinose.

The cœnenchyma is rather thick, but filled with irregular spicula, many of which are flat and irregularly lobed and branched. The axis is black in the main branches; soft and yellowish brown in the smaller ones. When dried the cœnenchyma is dark brown or nearly black.

The projecting, flattened, spinose spicules of the calicles (Fig. 3 a, *c*, *d*) have rather broader, flatter, and stouter points than those of the preceding; the point which projects is roughened or rudely spinulated along the edge; the basal portion is strongly flattened, commonly longer than broad, and usually comprises considerably more than half the whole length; it is sometimes oblong, sometimes more or less triangular; the sides and base are more or less deeply incised or lobed, the divisions are partly acute, and are numerous and narrow, but not very long, and many are again divided into smaller lobes and rough points. These measured .86 by .28, .77 by .33, .77 by .29, .67 by .29, .62 by .24, .57 by .19, .48 by .21 mm. They are accompanied by smaller, irregular, lobed and incised flat spicula, and by still smaller roughly warted spindles.

In the cœnenchyma there are many rather large, flat, rudely oblong or irregular, rough spicules (Fig. 3 a, *i*, *j*, *k*), of various sizes, which are strongly and irregularly lobed and incised, all around; they vary greatly in shape, but have no projecting point. Some of these measured .67 by .33, .62 by .33, .57 by .24, .53 by .29, .53 by .24, .42 by .24, .43 by .19 mm. These are mingled with and more or less concealed by smaller, roughly warted spindles, which are often crooked.

The arched transverse spicula (Fig. 3 a, *h*), within the margin of the calicles, are long, slender, finely warted, strongly bent in the middle, tapered and acute at both ends. Some of these measured .90 by .05, .80 by .038, .76 by .05 mm.

The convergent spicula from the polyps and bases of the tentacles (Figs. 3 a, *g*, 3 b) are similar but less curved, and the largest of them are a little stouter. Some of these are .85 by .07, .76 by .038, .71 by .05 mm.

Two specimens, of large size, were taken at Station 306, off George's Bank, in 524 fathoms, N. Lat. 41° 32′ 50″, W. Long. 65° 55′. The larger one is over 2 feet high (620 mm.) and 18 inches (456 mm.) broad.

One of these had many of the branches dead, and incrusted by a small variety of *Epizoanthus Americanus;* on it there were also specimens of an actinian (? *Urticina*, sp.) and of a barnacle (*Scalpellum*).

A large dead and denuded gorgonian, probably this species, from Station 317, in 333 fathoms, N. Lat. 31° 57′, W. Long. 78° 18′ 35″, is curiously covered, over nearly its whole surface, by small confluent actiniæ (Plate VI. Fig. 9).

Several fine examples, some of them of large size, have been brought from the fishing banks, off Nova Scotia, by the Gloucester fishermen, and presented to the U. S. Fish Commission.

Paramuricea tenuis VERRILL, sp. nov.

Coral rather slender, flabellate, thickly branched, the branches occasionally coalescent, the main branches ascending and giving off numerous much smaller, widely divergent lateral branches, which mostly divide again in the same manner ; final branchlets slender. Axis soft, light brownish yellow, finely striated, having a wood-like appearance. Cœnenchyma thin, dull gray or brown in alcoholic specimens, filled with a great abundance of rather small, fusiform and irregular-shaped, often bent, very roughly warted spicula, which lie at all angles, one end of many of them projecting slightly from the surface as small conical spinules. Calicles not crowded, mostly arranged along the edges of the smaller branches and branchlets in a single row on each side, small, short, cylindrical or verruciform, usually swollen at the base, the summit conical in contraction, consisting of eight clusters of acute, convergent spicula, corresponding to the bases of the tentacles and surrounded by a circle of slender curved spicula, just within the margin. The spicula forming the sides of the calicles are mostly fusiform and very roughly warted; those at the margin project but little.

Height of a moderate-sized specimen, 160 mm.; breadth, 150 mm.; diameter of the stem near the base, 3 mm.; of the branchlets, without the calicles, .75 mm.; diameter of the calicles, .6 mm.; height, about .5 mm.

Taken at Station 272, in 76 fathoms, off Barbados, by the Blake, in 1878–79, and at several other localities in the same region.

This species is allied to *P. borealis*, but is more slender, and has smaller spicula, which are different in form, and the surface of the cœnenchyma is spinulose.

Family PLEXAURIDÆ.

Eunicella modesta Verrill, sp. nov.

Plate II. Fig. 3.

Coral small, sparingly branched, nearly in a single plane, with large, low, round-topped, verruciform calicles. Base expanded, adhering to shells, etc. The main stem sends off a few branches, of about its own size; these spread abruptly at base, and then bend upward in a broad curve; they give off a few rather long, ascending branchlets, mostly from the outer curvature (in larger specimens these would probably divide farther in a similar way). The axis is round, horny, dark chestnut-brown in the larger branches, soft and yellow in the smaller ones. The calicles are rather large, low, rounded verrucæ, forming a close double row along each margin of the branches; they are mostly in contact, or nearly so, at their bases, in the rows, but leave a narrow, irregular, barren zone along the middle of the sides; the tentacles are entirely retracted and the aperture is usually completely closed up, so that the summit of the calicle is evenly rounded, or shows only a slight pit in the centre; sometimes it shows eight faint grooves and ridges. The entire surface is covered with the exposed, smooth, rounded, outer ends of the club-shaped spicula, forming the outer layer; these give the surface an evenly, regularly, and finely granulated appearance, under a lens. The color is white in alcohol.

The largest specimen is 120 mm. high and 65 mm. broad; diameter of the branches, 2.5 to 3 mm.

The club-shaped spicula (Fig. 3, *a*) of the cœnenchyma are remarkable for the smoothness and evenly rounded form of the larger end; at the smaller end there is usually a single group of small warts; sometimes there is another whorl a little higher up. These clubs mostly measure from .13 to .16 mm. in length, and .03 to .05 mm. in greatest breadth. There are also some double-headed warty spicules (Fig. 3, *c*), about .15 by .07 mm.; a few compound double-spindles, about .25 by .03 mm.; and some simple, warty, fusiform spicula or spindles (Fig. 3, *b*), usually acute at one or both ends, and more or less curved ; the larger of these measure about .25 by .03 mm. to .25 by .04 mm.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
318	337	31° 48′ 50″	77° 51′ 50″	2

Family BRIAREIDÆ.

Anthothela Verrill.

Proc. Nat. Mus., II., 1879, p. 199.

Coral either incrusting or irregularly branched. Branched forms with a distinct spiculose axis, composed of fusiform spicula. Calicles prominent, not capable of being contracted within the cœnenchyma, eight-lobed at the summit.

Anthothela grandiflora (Sars) Verrill.

Briareum grandiflorum Sars, Fauna Litt. Norvegiæ, p. 63, pl. 10, figs. 10–12.
Anthothela insignis Verrill, Check List Mar. Invert. N. England, 1879, p. 15.
Anthothela grandiflora Verrill, Notice of Recent Addit. to Mar. Invert., Part I., in Proc. National Mus., II., 1879, p. 199.

Plate IV. Figs. 6, 6 a.

This species grows in various irregular shapes. It sometimes spreads over and completely incrusts shells, pebbles, sponges, hydroids, and especially the dead and denuded axes of gorgoniæ, particularly of *Ceratoisis ornata* and *Paragorgia arborea.* At other times it grows up into more or less slender sparingly and irregularly branched forms, the branches often reuniting, and several inches in length. When incrusting gorgoniæ it is apt to run out beyond the ends of the gorgonian branches, continuing them by branches of its own. The cœnenchyma is rather thin, firm, and coriaceous, composed of irregular longer and shorter coarsely and roughly warted fusiform and oblong spicula.

The axis, in the branched forms, is sufficiently distinct, though not very different from the cœnenchyma in consistency ; it is composed of strongly and roughly warted fusiform spicula similar to those of the cœnenchyma, but mostly more slender and with fewer warts ; these are rather compactly crowded together. The calicles are large and prominent, usually, in alcoholic specimens, hour-glass shape, largest distally, and with a constriction near the top below the bases of the tentacles ; sometimes they are verruciform; the upper part is eight-lobed, and more or less eight-ribbed. The tentacles are commonly incurved and contracted in the form of eight convergent lobes on the top of the calicles. They are filled with numerous large, fusiform, warty spicula. The calicles are filled with roughly warted spicula (Fig. 6 a, *g*, *h*), similar to those of the cœnenchyma; they are arranged in convergent series along the ribs of the distal portion of the calicles, beyond the constriction.

Color, in life, pale yellow or buff; in alcohol, it is white, or yellowish white.

This species has been obtained in several instances by the Gloucester halibut fishermen in deep water, on the fishing banks, off Nova Sootia, and presented to the U. S. Fish Commission. It was first obtained by Captain N. McPhee and crew of the schooner "Carl Schurz," off Sable Island.

It was dredged, in 1881, by the U. S. Fish Commission, off Martha's Vineyard, at Station 1031, in 255 fathoms. It was not dredged by the Blake.

Anthomastus grandiflorus Verrill.

Anthomastus grandiflorus Verrill, Amer. Jour. Sci., XVI., 1878, p. 376.

Plate I. Figs. 7, 8, 9, 10, 10 a, 10 b.

Thirty-three specimens were taken at Station 329, off Beaufort, N. C., in 603 fathoms.

Many of these are very young, and are decidedly unlike the adult in appearance. They have a rather narrow peduncle, expanding upward to the broader, convex or flattened summit, where there are only three to five large polyps, arranged remotely around the margin, leaving the central area of the summit covered with numerous small asexual zoöids. Some of these young have the peduncle short, but in others it is remarkably elongated (Fig. 8). In all cases it terminates at the base in several, often numerous, lobulate branches, which are more or less subdivided into lobes, irregular in form and size, but mostly having small constricted bases, so that they are easily broken off. In most cases the polyps are still expanded, but in some they are all retracted. The color is dark red.

The smallest specimen obtained has two well-developed polyps, and two others just budding out. Similar specimens were dredged in large numbers, off Martha's Vineyard, in 1881, in 410 to 458 fathoms.

The specimens from the fishing banks, off Nova Scotia, both large and small, are mostly attached to stones by a broad incrusting base. In the larger specimens the peduncle becomes short, and the upper or polypiferous part large, round and convex, or capitate, often several inches in diameter and height, with twenty or more polyps scattered over the surface, but with a more or less marked tendency to form one or more rows around the border and to leave the central area comparatively bare. The surface of the cœnenchyma is finely granulous, with a great abundance of small red spicula, which make the texture firm and somewhat rigid. The polyps are very large, with long tentacles, but they are capable of entire retraction, though often exsert in alcoholic specimens. When the polyps are entirely retracted there are no prominent calicles, although the parts around the eight-rayed apertures are often swollen.

In partial contraction the contracted polyps, with their tentacles, often form large verrucæ.

Small zoöids are scattered over the surface between the polyps; sometimes these are prominent, in the form of small verrucæ; at other times they are so contracted as to be inconspicuous. The color is red, varying from bright cherry-red to dark red.

A well-grown specimen, but not the largest examined, measured across the polypiferous summit, 82 mm.; diameter of peduncle, 50 mm.; height of peduncle, 30 mm.; of polypiferous mass, 30 mm.; length of polyps as expanded in alcohol, 36 mm.; diameter of body, 7 to 9 mm.; breadth across expanded tentacles, 25 to 30 mm. (about 1 to $1\frac{1}{4}$ inches). The tentacles and their pinnæ are filled with slender fusiform or needle-shaped acute spindles.

The red spicula of the external part of the cœnenchyma are abundant, of various forms, but mostly rather small, and very roughly warted. The largest are irregular, oblong and fusiform, roughly and unevenly spinulated spicula (Fig. 10 a, *c*), sometimes swollen in the middle, sometimes near one end; the warts or spinules are usually large and prominent, but scattered and unequal; on some of the longest and most regular fusiform spicula they are smaller and more regular. The former measure .20 by .06, .20 by .03, .19 by .04, .18 by .05, .17 by .06, .15 by .05 mm.; the latter, .33 by .05, .32 by .03, .30 by .03 mm. With these (Fig. 10 a, *d*) there are large numbers of much smaller, short, very rough spicula (double-heads) with a narrow naked space in the middle and a whorl of long, sharp, rough warts near each end; some of these have each end terminated by a cluster of rough spinules; others are a little longer, with the ends acute, or with two or three spinules. The double-heads measure .09 by .07, .08 by .06, .08 by .05, .07 by .06, .07 by .05 mm. Among these there are also some small, rough, four-parted or cross-shaped spicula, of similar size.

The spicula of the interior of the cœnenchyma are similar, but larger and more strongly warted spindles (Fig. 10 b, *g*) and double-heads (Fig. 10 b, *f*). With these there are, however, numerous rough and coarsely marked club-shaped spicula (Fig. 10 b, *e*), some of them elongated, others much shorter; they have whorls of rough prominent warts at the larger end, becoming smaller toward the smaller end, which is acute. The larger fusiform spicula measure .36 by .08, .35 by .06, .28 by .09, .26 by .08, .23 by .08, .18 by .07 mm.; the clubs measure .19 by .08, .18 by .08, .16 by .06, .15 by .08, .13 by .07, .11 by .06 mm.; the double-heads, .13 by .08, .12 by .07, .08 by .05 mm.

The Gloucester fishermen first collected this species on the deep-water fishing banks, off Nova Scotia, in 1877 and 1878. Since that time they have brought in numerous specimens and presented them to the U. S. Fish Commission. These have come from off George's Bank, Le Have Bank, Banquereau, Sable Island Bank, Grand Bank, etc., in 150 to 300 fathoms. Numerous specimens were dredged by the U. S. Fish Comm. steamer Fish Hawk, off Martha's Vineyard, in 410 to 458 fathoms, 1881. It was also dredged in the Caribbean Sea by Mr. A. Agassiz, on the Blake, in 1878–79.

List of specimens dredged by the Blake, 1878–80 : —

Station.	Fathoms.	Locality.	Specimens.
1878–79.			
190	524	Off Dominique	1, good size.
196	1030	Off Martinique	1 young.
227	573	Off St. Vincent	1 "
265	576	Off Grenada	1 "
1880.			
329	603	N. Lat. 34° 39′ 40″, W. Lon. 75° 14′ 40″	33, mostly young.

Family ALCYONIDÆ.

Eunephthya Lütkeni (Marenz.) Verrill.

Alcyonium glomeratum Lütken, MSS. (*non* Johnston).

Eunephthya glomerata Verrill, Amer. Jour. Sci., XLVII., 1869, p. 284 ; Proc. Essex Inst., VI., 1869, p. 97.

Ammothea Lütkeni Marenzeller, Denk. Akad. Wien, XXXV., 1878, p. 272 [16].

Alcyonium Lütkeni Verrill, Notice of Recent Addit. to Mar. Invert., Part I., in Proc. Nat. Mus., II., 1879, p. 200.

Plate IV. Figs. 7, 7 a.

The main stem is upright, without polyps, giving off cylindrical branches along the sides; from these, small lateral branchlets arise all along the sides as well as at the ends, each bearing a cluster of three to five, or more, prominent polyp-calicles, which are larger than in *A. carneum*, and, when contracted, are obovate, incurved, and show the bases of the eight tentacles as small terminal lobes. The surface or outer layer of the polyp-bodies and bases of the tentacles is filled and covered with spicula, so as to render them decidedly rough, rigid, and incapable of complete contraction. The calicles are more or less distinctly eight-ribbed; the stouter spicula project slightly in rough points along the ribs, while those in the intervals, which are more slender, fusiform and warted, are imbedded in the integument.

The cœnenchyma is rather firm and stiff, due to the abundance of the spicula.

The larger spicula (Fig. 7 a, *b*) are rather large, long, stout, mostly club-shaped in form, with the smaller end thickly covered with small warts, and the large end covered with large, roughly lacerate warts, sometimes taking the form of ragged spinules, in other cases having the form of lacerate, flattened lobes; with these are some roughly warted fusiform spicula, of similar size (Fig. 7 a, *c*), and numerous smaller rough spicula, some of which are fusiform (Fig. 7 a, *d*) and others club-shaped, some of them slender and others stout.

Height, in alcohol, 60 to 80 mm. or more (about 3 inches); breadth, 35 to 50 mm.; diameter of contracted calicles, 1 to 1.25 mm.

One small specimen was dredged by the Blake, at Station 339, in 1186 fathoms, off Delaware Bay. Several examples were dredged in 1877, off Halifax, N. S., in 52 fathoms, by the U. S. Fish Commission. Several good specimens have been obtained and presented to the U. S. Fish Commission by the Gloucester fishermen, from the deep fishing banks off Nova Scotia. Greenland (Lütken, Mus. Copenhagen).

The specific name (*Lütkeni*) was given to this species independently by Marenzeller and myself, at nearly the same time.

A species of this genus, *E. nigra* (= *Nephthya nigra* Pourt., 1868), closely allied to the above, occurs in 120 to 152 fathoms, in the Straits of Florida. It has a similar arrangement of calicles, but the latter, when contracted in alcohol, are a little larger, and not incurved, but stand out straight, showing eight symmetrical, convergent lobes at the summit, from which eight rather prominent spiculose ribs extend down the sides.

Gersemia longiflora Verrill, sp. nov.

Plate III. Figs. 6, 6 a, 6 b.

Coral tall, flexible, branched. The main stem has a naked basal portion, which expands below into a thin, membranous, hollow, cup-shaped basal disk, clasping mud. Stem cavernous, upright, giving off, on all sides, numerous unequal lateral branches; the larger branches subdivide in the same manner as the main stem, and some of these secondary divisions may again divide. The ultimate branchlets consist of three to five or more long, cylindrical or tubular calicles, usually collapsed in alcoholic specimens; these are in contact at their bases, without any intermediate cœnenchyma. The calicles are directed upward and spread but little; in the preserved specimens the sides of the calicles show eight distinct rounded ribs, nearly obsolete near the base, but becoming more prominent toward the summit, and terminating in eight triangular lobes. Tentacles, in the preserved specimens, are contracted into a compact bunch at the summit of the calicles, but do not seem to be capable of being entirely concealed. The cœnenchyma of the main stem and principal branches has a finely granulous surface, due to small, rough spicula. The surface of the calicles is somewhat roughened by numerous small, rough, elongated spicula, which are arranged in chevron. Color, in alcohol, yellowish white, grayish at base.

The spicula vary greatly in size and form; the longer ones are long, slender, sparingly warty spindles (Fig. 6 b, *c*, *d*), and stouter spindles of nearly equal length, but with more numerous and larger, irregular warts; with these there are numerous shorter, prominently warted, fusiform spicula (Fig. 6 b, *e*) of equal diameter, and other short, warty spicula that are scarcely more than twice as long as broad; small spicula of many other forms also occur, and among these there are some compound ones (Fig. 6 b, *f*, *g*).

Height, 110 mm.; greatest breadth, 60 mm.; diameter of main stem at base, about 10 mm.; length of the calicles, 8 to 10 mm.; diameter, 1 to 1.5 mm.

Station 339, in 1186 fathoms, N. Lat. 38° 16′ 45″, W. Long. 73° 10′ 30″, Blake Expedition, 1880, 1 specimen.

ACTINARIA.

Adamsia sociabilis Verrill.

Adamsia sociabilis Verrill, Amer. Jour. Sci., XXIII., March, April, 1882, pp. 225, 314, 315.

Plate VIII. Figs. 2, 3.

Column slender and long in full expansion, very changeable, smooth, with pores (cinclidæ) near the base; disk a little wider than the column; tentacles small, slender, in two circles, often held alternately erect and recurved. Mouth often protruded.

Color of column translucent, and usually conspicuously striped with alternate pink and flake-white longitudinal bands, the latter narowing upward; tentacles pinkish; mouth with pink lips, crossed by darker lines, between the small lobes. Height in expansion, about 10 to 14 mm.

This species is always carried about by a small hermit-crab (*Catapagurus socialis* Smith, formerly *Hemipagurus*), as represented in our figure.

It starts upon a small shell, usually *Cadulus*, or a pteropod (*Cavolina*), occupied by the crab when young. The base becomes much expanded and bilobed, the lobes often surrounding the aperture of the shell, and uniting beneath.

The basal disk, as it enlarges, secretes a thin greenish or brownish chitinous pellicle, which covers the shell and extends far beyond its aperture, thus increasing the space for the crab. Eventually the shell is usually entirely dissolved or absorbed, and in its stead there is only the conical or hood-shaped horny pellicle, in which the crab protects his abdomen. The crab is an active species, and habitually exposes more of its body than is usual in the group. It is probably able to swim free. The disk of the actinian, usually, if not always, is held downward, beneath and behind the legs of the crab. This position would be favorable for obtaining its share of the food, when the crab is eating.

This species was taken by the Blake, at Station 344, in 129 fathoms, N. Lat. 40° 1′, W. Long. 70° 58′.

It was taken off Martha's Vineyard, at many stations, in 76–410 fathoms, by the U. S. Fish Commission, in 1880, 1881, and 1882.

Sagartia abyssicola Verrill.

? *Phellia abyssicola* Koren & Dan., Fauna Litt. Norvegiæ, III., 1877, p. 78, pl. 9, figs. 3, 4.

Sagartia abyssicola Verrill, Amer. Jour. Sci., XXIII., 1882, pp. 314, 315.

Plate VI. Figs. 1, 1 b, 1 c.

Base broad, adherent, expanded and thin at the edges, often clasping the tubes of *Hyalinœcia artifex*, and also attached to pebbles and shells. Column in extension elongated, narrow in the middle, expanded at the summit, usually covered except near the summit with a rough, closely adherent coating of sand, foraminifera, etc., but some specimens are nearly naked. In contraction it may become low, broad-conical, sometimes nearly flat. Tentacles numerous, longer than the diameter of the disk, rather slender, acute, forming about three to five sub-marginal circles. Column dirty salmon or dull flesh-color; tentacles sometimes pale flesh-color, sometimes orange or salmon, frequently dark purplish brown, often with a darker streak on each side of the base in the paler examples; flake-white patches often occur between the bases, or at the margin, between the outer tentacles; disk usually darker orange-brown or purplish brown, with pale and dark brown radii. Pink thread-like acontia are emitted abundantly from pores scattered on the column, and from the mouth. The larger examples are often 25 to 35 mm. in diameter, and 40 mm. in height.

This was dredged sparingly by the Blake, at Station 310, in 260 fathoms, N. Lat. 39° 59′ 16″, W. Long. 70° 18′ 30″; and at Station 336, in 197 fathoms, N. Lat. 38° 21′ 50″, W. Long. 73° 32′. It was taken abundantly, in many localities, off Nantucket, Martha's Vineyard, and Delaware Bay, on pebbles, shells, dead *Echini*, worm-tubes, etc., in 75–640 fathoms, by the U. S. Fish Commission, in 1880, 1881 and 1882. It is usually the most abundant actinian in these depths. The *Actinia abyssicola* Moseley is probably a different species.

Sagartia Acanellæ Verrill, sp. nov.

Plate VI. Figs. 2, 2a.

A small orange-colored species, with numerous long slender tentacles, which, by its base, entirely surrounds and closely clasps the branches of *Acanella Normani*. In a view from above, the body is usually elongated elliptical, the longer diameter being in the direction of the branch, along which the basal membrane extends considerably beyond the body itself; the disk is also more or less elliptical and eccentric. In a side view the body is low and usually oblique, the end toward the distal part of the branch sloping more rapidly than the other; the sides are usually smooth, but sometimes show slight elevated ridges or small tubercles; the integument is more or less swollen, somewhat translucent, and shows the internal lamellæ as thin white longitudinal lines, with opaque, orange-colored reproductive organs between them, in the lower half. Upper margin nearly equal, even, well defined; a few small round points, on the sides, appear to be contracted pores (cinclidæ), but no acontia have been seen protruded. The base fits itself lengthwise to the crooks and angles of the branch to which it is attached; the edges of the basal disk completely unite by a close suture along the opposite side of the branch, and extend, in a tubular form, more or less along the branch, sometimes entirely covering up its tip. Tentacles very numerous and crowded in five, six, or more rows, long and very slender, in extension, often, even in alcoholic specimens, with long filiform tips, at other times shorter, subacute; their length even in preserved specimens often exceeds the height, or the transverse breadth of the body; the inner ones are larger and stouter; the outermost are much smaller, but long and slender, or almost filiform.

The color of the column varies from pale salmon to deep salmon and brownish orange, corresponding, in all cases, very closely with the color of the *Acanella* on which it is found. Tentacles usually darker than the body, often orange or orange-brown, sometimes light salmon, but frequently dark purplish brown, with paler tips. Disk similar to the tentacles, usually salmon radially streaked with brown; mouth large, often everted, frequently brown.

The larger examples have the longer diameter of the body above the base, 20 to 25 mm.; transverse diameter, 12 to 15 mm.; height, 10 to 15 mm.; length of tentacles, 10 to 15 mm.

The following specimens were dredged by the Blake in 1880: —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
306	524	41° 32′ 50″	65° 55′	Several, on *Acanella*.
307	980	41° 29′ 45″	65° 75′ 10″	" "
308	1242	41° 24′ 45″	65° 35′ 30″	" "
309	304	40° 11′ 40″	68° 22′	" "
310	260	39° 59′ 16″	70° 18′ 30″	" "
312	466	39° 50′ 45″	70° 11′	" "

This species has also been dredged at numerous stations, in 219 to 506 fathoms, off Martha's Vineyard, by the U. S. Fish Commission, often in large numbers, on *Acanella*, which is common there.

It has also often been brought in by the Gloucester fishermen, since 1878, from many localities on the deep fishing banks, off Nova Scotia, and from the Grand Bank. A similar species, possibly identical, occurs on deep-water gorgonians dredged by the Blake among the Antilles.

Sagartia spongicola Verrill, sp. nov.

Plate VI. Fig. 3.

A small, rather cylindrical, smooth, rosy or flesh-colored species, with a moderate number of tentacles, which are not very long.

Column, in extension, higher than broad, round, usually nearly cylindrical, but frequently changing in form. Base small, often rather broader than the column, flat, or clasping sponges, hydroids, etc. Tentacles not very numerous, arranged in two, three, or more rows, close to the margin, leaving a large part of the disk bare; they are rather small, a little stout, not very acute, variously curled. Acontia have not been seen ejected, but there are a few small, pit-like openings on the sides, which appear to be pores (cinclidæ). Some specimens show small verrucæ near the summit. The internal lamellæ show as white lines through the sides of the body.

Color of the body and disk pale pink, light rosy, or pale flesh-color, varying to salmon-color, translucent. Tentacles often darker colored, salmon, light orange to orange-brown, commonly with a flake-white ring or streak near the tip. The color is often nearly uniform throughout.

Diameter 10 to 20 mm. ; height 15 to 25 mm.

This species has been taken in large numbers, on hard sandy bottoms, among and on sponges and worm-tubes, in 72 to 158 fathoms, at a number of localities, off Martha's Vineyard and off Delaware Bay, by the U. S. Fish Commission steamer Fish Hawk, in 1880, 1881, and 1882. It was not obtained by the Blake.

Synanthus mirabilis Verrill.

Synanthus mirabilis Verrill, Amer. Jour. Sci., XVII., 1879, p. 474.

Plate VI. Fig. 9.

This is a small actinian, which grows parasitically on the dead axis of *Paramuricea grandis* and other gorgonians. In some cases it is so closely grouped as to completely cover the surface of several of the larger branches, or even of the entire coral. The base of each individual expands widely, and closely clasps the branch, often entirely surrounding it, the opposite lobes coalescing when they meet ; the basal membranes of adjacent individuals also unite where they meet, and in this way entirely conceal the gorgonian axis. In alcoholic specimens most of the individuals are contracted into rounded verrucæ, with the tentacles entirely concealed, but some are still expanded ; in these the tentacles are contracted into a short, stout, blunt shape, and are arranged in two alternating circles of about twelve each, with indications of another outer circle of much smaller ones. Mouth small, elliptical. Surface of the body usually smooth, sometimes wrinkled, or having the appearance of low, inconspicuous verrucæ. The basal membrane shows distinct, divergent, radiating lines, corresponding to the internal lamellæ, and these lines are also frequently visible on the column itself. Diameter of the polyps, in alcohol, mostly from 2 to 4 mm.

When this genus was originally constituted, I supposed that the close union of the polyps, at their bases, was due to basal budding. Possibly that may be the case, to some extent, but the later and better preserved specimens indicate that it is due to coalescence.

The specimens originally described were from off Nova Scotia, in 200 to 300 fathoms, on *Paragorgia*, *Primnoa*, etc., but were poorly preserved ; possibly they may be distinct from those described above.

Station 317, in 333 fathoms, N. Lat. 31° 37′, W. Long. 78° 18′ 35″, Blake Expedition, 1880.

Urticina perdix Verrill.

Urticina perdix Verrill, Amer. Jour. Sci., XXIII., 1882, p. 223.

Plate VII. Figs. 1, 1 a.

This is a very handsome and large species, which sometimes expands to a breadth of 200 to 250 mm. (8 to 10 inches) across the tentacles. More frequently the expanse is 125 to 150 mm., with the body 75 to 100 mm. high and broad. The body is very contractile and changeable in form.

It lives well in aquaria. Several specimens were kept alive all summer, at Wood's Holl, in 1881 and 1882.

Color: column curiously mottled and reticulated with soft yellowish brown, varying from a pale tint to deep orange-brown; the ground color is pale buff, and the two colors alternate in transverse bands, the darker bands usually wider below, and often zigzag, or even broken up into squarish patches, while brown lines often cross the pale bands, giving an irregularly checkered pattern. These bands and spots are usually finer and more crowded above; disk usually pale yellowish olive, sometimes purplish, more brownish near the mouth, with faint alternating radii of lighter and darker tints; lips chocolate-brown, or red-brown; tentacles similar to disk, but paler, with two or three broad and ill-defined bands of brownish or purplish, the one near the tip faint, the basal one broader on the sides.

This was dredged several times by the U. S. Fish Commission, in 1880 to 1882, in the warm belt, off Martha's Vineyard, in 61 to 115 fathoms. It has not yet been taken, except in this region. It was not obtained by the Blake.

Urticina consors Verrill.

Urticina consors Verrill, Amer. Jour. Sci., XXIII., 1882, p. 225.

Plate VIII. Fig. 4.

A delicately colored species, with a soft, smooth integument. Column elongated in expansion; above, occasionally showing a few warts and longitudinal plications; margin simple. Tentacles numerous, in about four circles, crowded toward the margin; they are rather short and stout, tapered, acute, the outer ones much smaller. Mouth with strong, whitish, gonidial grooves at both ends, and about ten lobes on each side, separated by darker grooves. Color of body nearly uniform salmon, or rosy; tentacles a paler shade of the same, the outer ones with a flake-white blotch at the base, outside; disk pale salmon, with a pale bluish tint, and with flake-white radii, forking at the tentacles; mouth bright orange inside, with lines of reddish brown on the lips. Height, about 2 inches; diameter, 1.5 inches.

This species was taken in small numbers, off Martha's Vineyard, in 160 to 312 fathoms, 1880 to 1882.

All the specimens obtained were on the backs of a brilliantly colored species of hermit-crab (*Sympagurus pictus* Smith), remarkable for large bright red patches on the basal part of its legs.

This species may not be a true *Urticina*. It resembles certain species of *Sagartia*, but no acontia were observed.

Actinauge VERRILL, gen. nov.

Type, *A. nodosa*, formerly *Urticina nodosa* (MÜLLER) VERRILL.

Large actinians, with the tentacles and upper part of the body capable of involution. Integument of body of two kinds; that of the lower part is firm, thick, and more or less coriaceous or parchment-like, with persistent, solid warts or tubercles, usually in vertical rows, and sometimes partially covered with a thin, chitinous epidermal coating; that of the upper part of the body forms a marginal, brighter-colored band, below the tentacles, where it is soft and lubricous, secreting mucus abundantly, and rising into longitudinal ridges, crests, or oblong tubercles, which run to and unite with the bases of all the tentacles. The basal disk may be broad and flat, adherent, or it may be bulbous, clasping mud, or it may ensheathe the branches of Gorgoniæ, etc. Tentacles long and large, contractile. Lips with large folds and gonidial grooves.

This genus, like *Actinernus*, has marginal prolongations of the wall, running to and uniting with the outer bases of all the tentacles, but in *Actinernus* there is no specialized submarginal zone, and the body is not verrucose.

It is also closely allied to *Urticina* Ehr. (*Tealia* Gosse), of which the type is *U. crassicornis*. But the latter has the integument soft and lubricous over the whole body, and there is no marked specialization of the submarginal zone; the tubercles, when present, are small, not much thickened, and of the nature of true suckers for attaching foreign substances; and when not in use may so contract as to disappear entirely; the submarginal zone is nearly smooth, with a definite upper margin, and there are no vertical ridges running in on the disk to join the bases of the tentacles, as in this genus and *Actinernus*.

Actinauge nodosa (FABR.) VERRILL.

Actinia nodosa O. FABRICIUS, Fauna Grönlandica, 1780, p. 350.
? *Actinia digitata* (*pars*) MÜLLER (? *non* GOSSE).
Urticina nodosa VERRILL, Amer. Jour Sci., VI., 1873, p. 440; VII., 1874, pp. 413, 500, pl. 7, fig. 7; XXIII., 1882, pp. 224, 315.
S. I. SIMTH & O. HARGER, Trans. Con. Acad., III., 1874, pp. 11, 54.

Plate VI. Figs. 6, 7, 8, 8 a.

This large species is very abundant in deep water, along our coast, and northward to the Grand Banks.

It varies greatly in appearance, especially when contracted in alcohol. It is capable of contracting to a much greater extent than *U. callosa* and *Actinernus nobilis*, and when preserved, the upper part of the column is generally strongly involuted and the tentacles concealed. In this condition the upper extremity is covered with convergent, strongly raised folds or crest-like ridges, larger and smaller ones irregularly alternating. These crests correspond in number to the tentacles, and run up somewhat on their outer bases; the larger ones, which correspond to the inner or primary tentacles, can be traced inward between the outer tentacles, until they run to and coalesce with the external basal portion of the inner ones. The upper portion of the column, covered by these ridges and crests, is strongly differentiated from the part below it, for its integument is soft and lubricous, and usually decidedly red or pink in color during life; this portion, in fact, like the tentacles, secretes an abundant mucus, which is strongly phosphorescent. A row of large rounded warts or tubercles, or a more or less marked, transverse, verrucose ridge separates this upper or submarginal zone from the general surface of the column, which is firmer, more or less verrucose, and generally wholly or partly covered with a dirty brownish, somewhat chitinous, tough and firmly adherent coating, which is strongly wrinkled in contracted specimens, and sometimes has hydroids, bryozoa, and even such shells as *Anomia* adhering to its surface. This covering is often partially, and sometimes wholly wanting, especially in very large examples. It often persists on the larger upper verrucæ, even when absent elsewhere, and in some rather exceptional specimens it is much thickened on these warts, or even forms for them hard conical tips, sometimes affecting thus only the uppermost row, but at other times several series of them.

The most common form (Fig. 6) in expansion has the body more or less cylindrical, varying to hour-glass shape. The base may be broad and flat, often much broader than the body, and adherent to stones and shells; it may closely clasp cylindrical worm-tubes, branches of gorgoniæ, etc.;* or it may be deeply concave and bulbous, and enclose a mass of sand and mud.† Specimens with these different styles of base may all occur in the same locality, without other corresponding differences.

The column is covered with hard, prominent, and persistent verrucæ, arranged in pretty regular vertical and transverse rows, the upper ones becoming larger and more prominent, often with a hard, sharp tip, the lower ones gradually diminishing. At a short distance below the upper edge there is a transverse ridge, or row of large tubercles, above which the character of the tubercles and of the integument abruptly changes, the rounded verrucæ being replaced by longitudinal ridges and crests, alternately larger and smaller. In other cases the verrucæ become nearly obsolete below the middle, or are indicated only by longitudinal and transverse wrinkles. In very large examples the lower part of the body is usually nearly smooth and naked, with a firm, cartilaginous texture, but higher up there will usually be some very large, low, rounded verrucæ or tubercles, on some of which the brownish chitinous or epidermal coating is usually retained.

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* This habit is still more common with several other species from the same localities. Among these are *Actinauge nexilis* V., *Sagartia abyssicola*, *S. Acanellæ* V., etc.

† These enclosed masses of bottom often afford us accurate data as to the precise nature of the bottom sediments, with the relative proportions of mud, sand, &c. in their original condition, for this matter is clasped so tightly that no part can wash out.

The tentacles are not very large, moderately long and slender, changeable, with the tips either acute or obtuse; in large examples they are numerous, forming several rows.

The color of the body, in life, is usually white, dull pale red, flesh-color, or salmon, where it is not concealed by the dirty, dark brown epidermis; the verrucæ are often whitish or pink, while the wrinkles and grooves between them are dark brown or mud-color; the submarginal zone, which is 15 to 20 mm. or more broad in the larger examples, is bright red, orange-brown, or chocolate-brown; the color is often in stripes of darker and lighter tints. The tentacles are usually dark pink, salmon, orange or orange-brown, varying to dull red and chocolate-brown. Disk usually orange or reddish brown, or chocolate, with lighter and darker radii.

This species grows to a large size. Examples are often taken that are 80 to 100 mm. (4 inches) in diameter, and 100 to 150 mm. (6 inches) high. Ordinary adult specimens are 50 to 75 mm. broad, and 80 to 100 mm. high, with the larger tentacles about 15 to 20 mm. long.

Of the typical variety, a number of specimens were taken by the Blake, south of George's Bank and off Martha's Vineyard, at Stations 303, 309, 310, in 260 to 306 fathoms; at Station 332, off Cape Hatteras, in 263 fathoms; and at Station 336, off Delaware Bay, in 197 fathoms.

It has been taken by the U. S. Fish Commission at a large number of stations on the Gulf Stream Slope, off Martha's Vineyard, Nantucket, and Long Island, and off Chesapeake Bay, during 1880, 1881, and 1882, in 86 to 506 fathoms. In this region it is often very abundant, and of large size, in 160 to 506 fathoms. The smaller ones mostly occur clasping the tubes of *Hyalinœcia;* the large ones generally enclose a ball of sand and mud, in the bulbous base. It has also been taken by the Fish Commission off Cape Cod, in 50 to 90 fathoms, 1879, 1882; Gulf of Maine, Massachusetts Bay, Casco Bay, Bay of Fundy, in 50 to 150 fathoms, 1872 to 1879; off George's Bank, in 430 fathoms, on the Bache, 1872; off Nova Scotia, in 50 to 110 fathoms, 1877.

The Gloucester fishermen have brought it in from a large number of localities, on all the fishing banks, from George's to the Grand Bank, in 30 to 300 fathoms. It is particularly common on the stony bottoms of Le Have Bank, Western Bank, and Banquereau, off Nova Scotia.

The description of this species by Fabricius, from Greenland examples, applies accurately to one of our commonest varieties. I have also received two examples from Denmark, through Dr. Chr. Lütken, of the Copenhagen Museum, which, so far as can be seen from the alcoholic specimens, agree perfectly with some of our less nodose varieties. These were sent as *Actinia digitata* Müller. But the *Actinia* (or *Tealia*) *digitata* of Gosse and several other European writers may be a distinct species.

Variety **coronata** nov.

Plate VI. Figs. 8, 8 a.

This variety is chiefly peculiar in having one or two of the upper transverse series of verrucæ much more prominent than usual, and tipped by a conical, often acute point of hard chitinous material, of the same nature as the coating over the general surface, but thicker and harder. The lower part of the column may be covered with low tessellated verrucæ, or it may be nearly smooth. The base, in nearly all the examples of this variety that I have seen, is flat and adherent. The few specimens of this kind in my possession are mostly less than an inch in diameter. They are mostly from deep water, 300 to 980 fathoms. Intermediate states between this and the normal form are not rare. From Station 307, in 980 fathoms, there is a peculiar specimen (Figs. 8, 8 a) of this variety, in which there is a single circle of twelve very prominent, sharp-pointed verrucæ around the retracted summit; the lower part of the column is irregularly wrinkled and covered with a tough and closely adherent dark brown epidermis.

Variety **tuberculosa** nov.

Plate VI. Fig. 7.

This is a remarkable form, perhaps a distinct species. The column is covered with large, distinct, irregularly scattered, round or hemispherical, solid tubercles, which are persistent. The upper retractile border has irregular, strong, longitudinal, unequal crests. The surface of the column is covered with a firm dark brown epidermis. The base is broad and adherent to stones, lumps of mud, etc. The tubercles in alcoholic specimens are generally white, the surface between dark brown. Height in alcohol, 40 to 70 mm.; diameter, 25 to 45 mm.; diameter of tubercles, 5 to 10 mm.

I have never seen this variety alive, and therefore hesitate to separate it as a species, although it may very well prove to be distinct. I have seen no truly intermediate forms.

This variety has often been brought in from various localities, on the fishing banks off Nova Scotia, etc., by the fishermen of Gloucester, Mass., and presented to the U. S. Fish Commission by them. It has been dredged by the U. S. Fish Commission in the Gulf of Maine and off Nova Scotia. It was also sent to me by Mr. J. F. Whiteaves, who dredged several specimens of it in 1872, in the Gulf of St. Lawrence, off Anticosti Island, in 112 fathoms.

Actinauge longicornis VERRILL.

Urticina longicornis VERRILL, Amer. Jour. Sci., XXIII., March, 1882, p. 222.

Plate V. Figs. 1, 2.

This is a very large and beautiful species, remarkable for the large size, great length, and delicate coloration of its tentacles, and for the whitish or rosy parchment-like character of the integument, below the well-defined submarginal zone. It is highly contractile. The tentacles are often carried erect and divergent, but the outer ones are often gracefully recurved; they are submarginal, in four or five rows. Adult specimens are often 80 to 90 mm. in diameter of body, and 100 to 125 mm. high, exclusive of the tentacles, which may be 45 to 65 mm. long; the breadth across the expanded tentacles may be 150 to 200 mm. (6 to 8 inches). The disk can expand very broadly.

Large specimens have vertical rows of persistent, but small and not very prominent verrucæ, below the submarginal zone, fading out toward the base. In some examples these verrucæ become more numerous, and more or less crowded along the rows, but they are never very large. The submarginal zone is soft and lubricous, and probably phosphorescent, though this was not determined by us. It is covered by longitudinal ridges and crests, alternately larger and smaller, and usually with darker and lighter stripes of orange-brown, or purplish brown color. The column below this is whitish or pale pink.

The long, tapering, acute tentacles are translucent, usually delicate pink or rose-color, and sometimes light purplish brown, usually with an ill-defined whitish ring at the base, and pale tips. The disk is usually whitish or pale rosy pink, and has broad radii of deep rose-red, or sometimes dark purplish brown, running from near the mouth to and between the bases of the tentacles, four of them usually passing between each pair of inner tentacles. Lips orange-brown or reddish, with deeper brown stripes on the large lateral folds; the large gonidial grooves are paler.

The basal disk of the large specimens is almost always deeply concave, or bulbous, clasping and almost entirely enclosing a large mass of sand, etc. Young specimens are often attached by the clasping base to worm-tubes, and stems of *Tubularia indivisa*, etc. In these cases the edges of the disk wrap around and unite in a fine close suture on the opposite side of the support, thus forming a closed sheath, which may extend for some distance along the enclosed object, and when there are several specimens near together the edges of their bases may also unite continuously by similar sutures.

A strongly contracted specimen, of moderate size, apparently of this species, was taken by the Blake at Station 327, in 178 fathoms, off Beaufort, N. C., N. Lat. 34° 0′ 30″, W. Long. 76° 10′ 30″. The upper part of this is densely covered with small prominent verrucæ; the lower part, with small scattered warts; the integument is firm and somewhat leathery, or parchment-like, but very flexible and not very thick.

It has been taken by the U. S. Fish Commission steamer Fish Hawk, in 1880, 1881, and 1882, at many stations off Martha's Vineyard, in 100 to 325 fathoms. Many young ones were also taken off Delaware Bay, in 130 fathoms, adhering to hydroids, worm-tubes, sponges, etc., and often united by their bases into curious clusters.

Actinauge longicornis, var. Caribæa VERRILL, nov.

Grows to very large size. One of the largest has the base clasped around a bundle of large silicious sponge spicules, like those of *Hyalonema.* This in alcohol has the body four inches in breadth; the base along the sponge spicula is six inches. Other large specimens hold globigerina and pteropod ooze in the bulbous base. The young mostly clasp branches and stems of *Gorgoniæ*, the basal edges uniting in a firm suture even when very small.

It resembles, when in alcohol, certain specimens of *longicornis.* It has a similar thick, parchment-like, white, naked integument, which is more or less reticulated by wrinkles, leaving slightly marked squarish elevations, on the middle of which there is often a small round wart.

Rather small, smooth, rounded, persistent verrucæ are sparingly distributed over the surface, above; they are arranged in longitudinal rows, and become smaller and more remote below, fading out above the base; some of the uppermost are often surmounted by a small, central, dark brown patch of a chitinous epidermal coating. The submarginal zone is crossed by numerous elevated ridges, which run to and join the bases of the tentacles, as in the typical form; but in most of the specimens dissected, they become larger and more swollen next the tentacles, and run far up their outer sides, so as to cause their bases to be more swollen than in the similarly preserved typical specimens, but these differences may be due largely to differing states of contraction. The tentacles seem to be fewer, relatively larger and longer, and more concentrated toward the margin, but of this it is not possible to judge accurately from alcoholic specimens.

Traces of orange-brown color remain, on some specimens, as a brown ring defining the lower edge of the submarginal zone, and as median stripes on the longitudinal ridges of this zone, and on their continuations on the outer bases of the tentacles.

The following specimens were dredged by the Blake, 1878–80.

Station.	Fathoms.	Locality.	Specimens.
1878–79.			
260	291	Off Grenada	1 large, on sponge spicules.
269	124	Off St. Vincent	2 j. on *Gorgonia*.
295	180	Off Barbados	2 l. clasping mud.
296	84	Off Barbados	1 l. " "
1880.			
XVIII.	600	N. Lat. 18° 20′ 30″, W. Long. 87° 16′ 40″	2 l. " "

Actinauge nexilis VERRILL, sp. nov.

Plate VI. Figs. 4, 5.

Column low and broad in preserved specimens, with a firm integument, to which a brown epidermal film usually adheres, especially toward the base and between the wrinkles of the upper parts. Surface of the upper half often more or less nodulous and wrinkled, becoming more so toward the margin, where the elevations become elongated ridges and crests. Base clasping the denuded axis of *Balticina* and other Pennatulidæ where these have been injured, most frequently on the upper end, but not uncommonly on other parts of the rachis, beyond which the polyps may be still alive. The lateral lobes of the base meet and coalesce around the axis, so as to form a tubular sheath, considerably beyond the breadth of the body. When two or more are crowded together, their basal disks unite where they come in contact, thus entirely covering the axis that supports them. Tentacles numerous, covering much of the disk, rather short, thick, tapering, but not seen in full extension.

Color of body usually pale salmon or flesh-color, with streaks of brown, in wrinkles; disk deep orange-brown, with darker brown radii; tentacles salmon-brown.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
310	260	39° 59′ 16″	70° 18′ 30″	4
327	178	34° 0′ 30″	76° 10′ 30″	1

It was dredged at several stations, off Martha's Vineyard, in 168 to 245 fathoms, on *Balticina*, by the U. S. Fish Commission, in 1881 and 1882.

Numerous specimens, from the various fishing banks off Newfoundland and Nova Scotia, have been brought in by the Gloucester fishermen. These are all on *Balticina*, and mostly from 200 to 300 fathoms.

Actinostola Verrill, gen. nov.

Type, *Urticina callosa* Verrill.

Size large, integument very thick, firm, leathery, lubricous, not very contractile. Column covered with large, irregular tubercles, not having the power of adhering to foreign substances; upper portion not essentially different from the rest, the surface being without specialized structures; margin indefinite, continuous with the bases of the smaller outer tentacles. Basal disk frequently smaller than the upper part of the column, usually concave and enclosing mud. Tentacles numerous, short, thick, more or less scattered over the disk, the inner ones much the largest, longitudinally sulcated, imperfectly contractile, not deciduous. Disk usually deeply concave; mouth large, with large, strongly lobed lips, and large gonidial grooves. The walls of the body are very thick, firm, leathery, and, although capable of considerable contraction longitudinally and transversely, they seem to be incapable of contracting sufficiently to withdraw the disk and tentacles; when handled, the column frequently becomes collapsed and longitudinally folded, and frequently takes an hour-glass shape, the disk and tentacles remaining fully exposed, although the tentacles may be very much diminished in size.

This genus is allied to *Bolocera, Urticina*, and especially to *Actinauge*. From the latter it differs in not having the upper portion of the column specialized and different from that below, and also in being far less contractile. *Urticina* differs in not having the large non-adhesive tubercles, the warts, when present, being of the nature of adhesive suckers, and also in having the walls of the body and tentacles highly contractile. *Bolocera* differs in having the column smooth, or nearly so, with the tentacles long and easily deciduous. *Actinernus* differs in having the column smooth, and in having the upper margin divided into lobes which run up on the outer sides of the tentacles.

Actinostola callosa Verrill.

Urticina callosa Verrill, Amer. Jour. Sci., XXIII., March and April, 1882, pp. 224, 315.

Plate VII. Fig. 2.

This is, perhaps, the largest of the eight large species of actinians that inhabit these depths, though *A. nodosa*, *A. longicornis*, *U. perdix*, and *Bolocera Tuediæ* grow about as large. It is also remarkable for the great number of short, stout, usually blunt, striated tentacles. When full grown it has a remarkably firm, thick, leathery, but lubricous integument, and has but little power of contracting or rolling in the upper end. When handled it is apt to become irregularly flattened and collapsed, with broad longitudinal folds or wrinkles, while the tentacles and disk remain exposed, the very broad disk usually becomes deeply concave, and the tentacles contract in length and become blunt. The body usually narrows to the base, but may be hour-glass-shaped. The surface of the column is usually more or less covered with low, irregular, often flattish verrucæ, which become larger and more prominent, and sometimes form longitudial series or crests on the upper part, but fade out to mere wrinkles toward the base. There is no decided change in the character of the integument near the top, which is a conspicuous character in *A. nodosa* and *A. longicornis*.

The basal disk, in large specimens, is usually bulbous or deeply concave, firmly grasping a large mass of sand and mud, which it often nearly encloses. In the mud there are often numerous chitinous pellicles, which have been secreted and cast off from the base.

Large examples are often 150 to 180 mm. in height, with the expanded disk 200 to 250 mm. (8 to 10 inches) broad; the larger tentacles are about 25 mm. long, 5 to 6 mm. in diameter. Color generally salmon or orange, all parts often of nearly the same color; column almost always pale salmon or buff, varying to deep salmon or orange-red, with the tubercles paler; disk most often deep salmon, or generally of the same color as the body, but darker in shade, with paler radii; the large lateral lobes of the lips are like the disk, but darker, usually salmon or orange-brown, the large gonidial grooves whitish or pale yellow; tentacles usually plain deep salmon or orange-brown, with paler striæ or reticulations.

Young specimens, from 15 to 20 mm. in diameter and 20 to 30 mm. high, have been taken at several localities, off Martha's Vineyard, by the U. S. Fish Commission. These are usually more or less obconic, or pear-shaped, with the base narrow and the upper part of the body swollen. The base, in these, is generally concave, clasping mud or sand, but in several cases it is clasped around a worm-tube, or some similar object. Probably, when very young they may all have this habit of attaching themselves to some solid object, which is abandoned later. A small specimen, of similar character, was taken by the Blake, at Station 311, in 143 fathoms.

These young specimens have the tentacles not very numerous, in few rows, the inner ones much the longest, stout and pointed, the outer ones short and acute. The surface of the body is smooth, or nearly so, and is usually tinged with chocolate-brown or purplish; a darker brown ring surrounds the margin, at the base of the tentacles; the tentacles and disk are, usually, deep purplish brown. In these the integument is much thinner than in the adult, and more or less translucent.

Of this species large and typical specimens were obtained by the Blake, off George's Bank, at Station 303, and off Cape Fear, N. C., at Station 326, in 464 fathoms. These, as usual, enclose, in the deeply concave basal disk large masses of mud and sand. One of those from Station 326 was also adherent, by one edge of the disk, to worm-tubes.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
303	306	41° 34′ 30″	56° 54′ 30″	3 l., clasping sand and gravel.
326	464	33° 42′ 15″	76° 0′ 50″	2 l., 3 m., clasping mud and sand.
311	143	39° 59′ 30″	70° 12′ 0″	1 young, clasping stem.

Large specimens have been taken by the U. S. Fish Commission, often in large numbers, at many stations, off Martha's Vineyard and Nantucket, in 100 to 640 fathoms, 1880–82; off Cape Cod, in 55 to 90 fathoms, 1879, 1882; Gulf of Maine, in 50 to 150 fathoms, 1873, 1877, 1878; off Nova Scotia, 1877. It has also been taken on George's Bank and the various fishing banks off Nova Scotia, in 45 to 300 fathoms, by the Gloucester fishermen, in considerable numbers. Also from the Grand Bank of Newfoundland, in 100 to 150 fathoms.

Actinernus saginatus VERRILL ?

Actinernus saginatus VERRILL, Amer. Jour. Sci., XXIII., 1882, p. 225.

A specimen in bad condition, perhaps of this species, was dredged at Station 326, off Cape Fear, N. C., N. Lat. 33° 42′ 15″, W. Long. 76° 0′ 50″, in 464 fathoms. Its form in contraction is low, broad obconic, with narrow base. Integument pale, cartilaginous. Tentacles numerous, small, slender, in two or three rows close to the margin. Disk broad, concave, and with the tentacles deep chocolate-brown; a zone of the same color surrounds the margin below the tentacles.

The original specimen was taken by the U. S. Fish Commission, in 458 fathoms, off Martha's Vineyard, 1881.

Bolocera Tuediæ (Johnst.) Gosse.

Actinia Tuediæ Johnston, Mag. Nat. Hist., V., p. 163, fig. 58.
Anthea Tuediæ Johnston, British Zoöphytes, ed. 2, Vol. I. p. 242, fig. 53.
Bolocera Tuediæ Gosse, Actinologia Britannica, 1860, p. 186, pl. 5, fig. 1.
Verrill, Amer. Jour. Sci., V., 1873, pp. 5, 14; VI., 1873, p. 440; VII., 1874, pp. 413, 500.

This large species is easily distinguished by its smooth, lubricous, stout, dull red body, and by the very large, non-retractile tentacles. It often expands 150 to 255 mm. (6 to 10 inches) across the tentacles. The tentacles are often 50 to 75 mm. (2 to 3 inches) in length, and 10 to 15 mm. in diameter. The body is ordinarily 75 to 100 mm. (3 to 4 inches) in diameter and height.

When detached, which often happens, the tentacles retain their plumpness and fusiform shape, and are capable of contracting and expanding, so as to change their form, for some time, so that they resemble, and are sometimes mistaken for, entire living worms or holothurians.

The color is usually some shade of red, varying from pale flesh-color and pink to dark red; the body, in the paler examples, is often more or less tinged with salmon. The disk and tentacles generally correspond in color with the body, but are deeper in tint. When the body is flesh-color or light red, the tentacles and disk may be rose-red or dark red, while those specimens that have a dark red body may have the tentacles reddish brown or orange-brown.

Fine large specimens were dredged by the Blake, at Stations 309 and 310, in 304 and 260 fathoms, off Southern New England.

Detached tentacles were taken off George's Bank, at Station 303, in 306 fathoms, N. Lat. 41° 34′ 30″, W. Long. 65° 54′ 30″. One large and characteristic specimen was dredged at Station 326, off Cape Fear, N. C., in 464 fathoms.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
303	306	41° 34′ 30″	65° 54′ 30″	1 tentacle.
309	304	40° 11′ 40″	68° 22′	1 large.
310	260	39° 59′ 16″	70° 18′ 30″	1 "
326	464	33° 42 15″	76° 0′ 50″	1 "

It has been dredged at a large number of localities by the U. S. Fish Commission, since 1872, in the deeper parts of the Bay of Fundy; off Nova Scotia, in 50 to 100 fathoms; Gulf of Maine, in 50 to 150 fathoms; off Casco Bay, in 40 to 90 fathoms; Massachusetts Bay, in 40 to 52 fathoms; off Cape Cod, in 37 to 90 fathoms. Off Martha's Vineyard, on the Gulf Stream Slope, it has been dredged, often in abundance and of large size, at many localities, in 160 to 640 fathoms, and sparingly in 65 to 125 fathoms, in 1880 to 1882.

A few specimens have been brought from the fishing banks, off Nova Scotia, by the Gloucester fishermen.

A closely related species (*B. Kerguelensis*) has been described by Studer from the Antarctic Ocean, off Kerguelen Island.

Epizoanthus Americanus Verrill.

Zoanthus parasiticus Verrill, Revision of Polyps, in Mem. Bost. Soc. Nat. Hist., I., 1864, p. 34 (*not* of Duch. & Mich., 1860).

Zoanthus Americanus Verrill, *op. cit.*, 1864, p. 45; Proc. Bost. Soc. Nat. Hist., X., 1866, p. 335.

Gemmaria Americana Verrill, American Naturalist, II., p. 9, fig. 42.

Epizoanthus Americanus Verrill, Amer. Jour. Sci., II., 1871, p. 361; Dana, Corals and Coral Islands, ed. 1, 1872, p. 62, figs. 1, 2; Report on Invertebrata of Vineyard Sound, in Report of U. S. Fish Commission, I., 1873, pp. 446, 510, pl. 38, figs. 286, 287; Amer. Jour. Sci., VII., 1874, p. 413; XXIII., 1882, p. 316.

Smith & Harger, Trans. Conn. Acad., III., 1876, p. 55, pl. 8, fig. 2.

Epizoanthus papillosus Gray, Proc. Zoöl. Soc. London, 1867, p. 237 (from Massachusetts Bay).

Plate VIII. Figs. 1, 6.

Two examples of a very singular variety (see Plate VIII. fig. 6) occurred at Station 332. These completely invest the tube of *Hyalinœcia*, and the polyps, which are of large size, form two regular opposite rows, of ten to twelve, on each side. A small incrusting variety occurred on *Paramuricea grandis*, at Station 305, almost completely covering several of the branches, their tips still remaining alive.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
303	306	41° 34′ 30″	65° 54′ 30″	3 on *Eupaguri*.
312	466	39° 50′ 45″	70° 11′	1 on stone.
316	229	32° 7′	78° 37′ 30″	1 on *Gorgonia*.
332	263	35° 45′ 30″	74° 48′	1, var., on *Hyalinœcia*.
333	65	35° 45′ 25″	74° 50′ 30″	Sev. on sand, shells, etc.
334	395	38° 20′ 30″	73° 26′ 40″	Sev. " " "
335	89	38° 22′ 25″	73° 33′ 40″	Sev. on sponges, etc.
336	197	38° 21′ 50″	73° 32′	1 on *Eupagurus*.
344	129	40° 1′	70° 58′	Sev. on *Eupaguri*.
325	71	40° 10′ 15″	71° 4′ 30″	1 on *Eupagurus*.

This is a very abundant species off our coast, in moderate depths. Many thousands of specimens have been taken off Nantucket, Martha's Vineyard, Long Island, and off Chesapeake Bay, in 28 to 487 fathoms, by the U. S. Fish Commission, in 1871, 1880, 1881, and 1882. It is most abundant in 60 to 200 fathoms. In these localities the variety forming the abode of hermit-crabs (mostly *Eupagurus politus* Smith and *E. Kröyeri*) is very common, but the variety consisting usually of one to three polyps attached to a grain of sand is equally or even more common, while the varieties creeping over or incrusting sponges, shells, hydroids, tunicates, pebbles, etc., is often very abundant on the harder bottoms. It had previously been taken repeatedly by the U. S. Fish Commission, from 1871 to 1879, in the Gulf of Maine; Bay of Fundy, in 40 to 109 fathoms, 1872; off Nova Scotia, in 50 to 190 fathoms, 1877; off George's Bank, in 60 to 430 fathoms, 1872. Also from the Gulf of St. Lawrence, incrusting variety, on rocks (coll. Whiteaves).

The Gloucester fishermen often brought it in from the various fishing banks off Nova Scotia and Newfoundland, in 100 to 300 fathoms, 1878–80.

It was originally described by me from specimens of the form covering shells occupied by hermit-crabs (in this instance *Eupagurus pubescens*), from off New Jersey, in 30 fathoms, — Capt. Gedney.

An incrusting variety, apparently identical with the corresponding form of our species, has recently been described from the coast of Norway, under the name of *Zoanthus Norvegicus*, by Danielssen and Koren.

Epizoanthus paguriphilus Verrill.

Amer. Jour. Sci., XXIII., Feb. 1882, p. 137.

Plate VIII. Fig. 5.

Coral large, leathery, nearly smooth, translucent, incrusting spiral shells inhabited by *Parapagurus pilosimanus* Smith. The polyps are large, elongated, swollen at base, more or less cylindrical, sometimes conical, at other times expanded at the summit. The surface is throughout smooth, glabrous, naked, or with a slight, imperfect coat of fine mud; margin, just below the tentacles, softer, smoother, and lighter-colored than the rest. In the larger specimens there is usually a circle of seven to twelve polyps, arising from the outer margin of the coral, and directed radially outward and somewhat upward; along that portion of the margin which covers the front of the crab, the circle of polyps is interrupted for a considerable space; elsewhere the bases of the polyps are in contact, or nearly so. The entire upper surface of the coral is convex and destitute of polyps. Usually the apex of the univalve shell on which the colony started may be seen through the translucent integument near the postero-lateral border, on the left-hand side. Sometimes the shell has entirely disappeared by absorption. In all cases the coral extends far beyond the aperture of the original shell, in a spiral direction, itself forming the principal part of the habitation of the crab. The lower surface is also convex and smooth, and destitute of polyps, except one, which always stands below and in front of the aperture, in a position which would correspond to the columella-lip of the spiral shell. The surface within the aperture, in contact with the crab, is coated with a smooth, brown film, not easily separable. The tentacles, in life, are rather slender in extension, very numerous, forming several distinct circles; in alcoholic specimens they are rather stout, short, tapered, subacute, nearly equal; in some cases they are entirely retracted, in others partially exposed. The color of the coral is translucent, bluish or purplish gray, or grayish brown. In fresh specimens the tentacles are pale orange or salmon, with lighter tips, and the polyps themselves partake more or less of salmon-color. In younger specimens the number of polyps is less in proportion to the age, but the arrangement is essentially the same.

Diameter of ordinary specimens, in alcohol, about 60 to 70 mm.; vertical thickness, 25 to 30 mm.; length of the polyps, 15 to 20 mm.; diameter in the middle, 10 to 12 mm.; at base, 12 to 18 mm. Some specimens considerably larger than this have been obtained.

This species was first taken by the Gloucester fishermen in deep water off the coast of Nova Scotia, in 1878, and by them presented to the U. S. Fish Commission. It has since been dredged by the U. S. Fish Commission off Martha's Vineyard, in 252 to 640 fathoms, 1880 to 1882 (Stations 880, 883, 893, 894, 938, 947, 994, 997, 998, 1028, 1029, 1122, 1124, 1140). At Station 947, in 312 fathoms, it was very abundant, several hundred having been taken at a single haul; at most of the other localities it was taken in small numbers.

The following specimens were dredged by the Blake, in 1880.

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
306	524	41° 32′ 50″	65° 55′ 0″	1
309	304	40° 11′ 40″	68° 22′ 0″	3 j.
322	362	33° 10′	76° 32′ 15″	4

Hitherto all the specimens of this species that have been taken have been occupied by *Parapagurus pilosimanus*, which has not been found by us in any other carcinœcium.

The young *Epizoanthus* evidently attaches itself to the shell when the crab is very small, for in most cases the enclosed shell is of small size, but by the growth of the polyp the aperture is enormously extended, so as amply to accommodate the crab after it has reached a large size. In the majority of specimens examined the original shell still remains, though usually entirely covered by the integument, but in some cases it seems to have been entirely dissolved and removed.

This species, although in habit like some of the varieties of *Epizoanthus Americanus*, is easily distinguished. It grows to a much larger size, with much larger polyps, and the surface is much smoother, more lubricous and translucent, and is destitute of the firmly adherent coating of sand always present on *E. Americanus;* moreover, the latter has a much less regular arrangement of the polyps, which usually stand out in radial directions, but at various angles.

MADREPORARIA.

Thecopsammia socialis Pourtalès.

Thecopsammia socialis Pourtalès, Bull. Mus. Comp. Zoöl., 1868, Vol. I. No. 7, p. 138; Illustrated Catalogue Mus. Comp. Zoöl., 1871, No. IV. Deep-Sea Corals, p. 44, pl. 2, figs. 9, 10.

Duncan, Madreporaria of the Porcupine Expedition, Trans. Zoöl. Soc. London, 1873, Vol. VIII. Part V.

Four specimens, all dead, were taken at Station 216, in 229 fathoms, N. Lat. 32° 7′, W. Long. 78° 37′ 30″, by the Blake, in 1880.

This species was taken by Mr. Pourtalès, on the Bache, off Florida, in 195 to 262 fathoms. It was also taken by the Porcupine Expedition, in 345 and 363 fathoms, north of Scotland.

Lophohelia prolifera Edw. & Haime.

Madrepora prolifera Pallas, Elench. Zoöph., 1766, p. 307.

Ellis & Solander, Zoöph., 1786, pl. 32, figs. 2, 3, 4, 5.

Lophohelia prolifera Edw. & Haime, British Fossil Corals, 1850, Intr., p. xx.; Hist. Nat. des Coralliaires, 1857, Vol. II. p. 117.

Duncan, Trans. Zoöl. Soc. London, 1873, Vol. VIII. Part V. p. 328.

Pourtalès, Deep-Sea Corals, 1871, p. 25, pl. 1, figs. 3, 4, 5; Bull. Mus. Comp. Zoöl., 1880, Vol. VI. p. 107.

Verrill, Amer. Jour. Sci., XVI., 1878, p. 377.

Moseley, Voyage of the Challenger, Report on the Corals, 1881, p. 178, pl. 6, figs. 7, 8.

Lophohelia affinis Pourtalès, Bull. Mus. Comp. Zoöl., I., 1868, p. 135.

A single dead specimen of this species was taken by the Blake, at Station 216, in 229 fathoms, N. Lat. 32° 7′, W. Long. 78° 37′ 30″.

Two specimens have been obtained by the Gloucester fishermen in deep water off the coast of Nova Scotia, and by them presented to the U. S. Fish Commission.

It has long been known from deep water off the coasts of Northern Europe, and from the Mediterranean. It was taken by Mr. Pourtalès on the Bache, off the coast of Florida, in 195 and 315 fathoms, and by the Blake, among the Antilles, in 291 and 874 fathoms. By the Challenger it was dredged among the West India Islands, in 390 and 450 fathoms; off St Paul's Rocks, in 100 fathoms; off Nightingale Island, in 100 to 150 fathoms. At the last-named locality fine specimens occurred in abundance. It was taken in large numbers by the Porcupine Expedition, off the European coasts. Studer records it from 50 fathoms, off Madeira.

The few specimens obtained from off our northern coasts are of the typical variety, and some are of large size, but all that I have seen were dead, though evidently recent.

Dasmosmilia Lymani POURTALÈS.

Parasmilia Lymani POURTALÈS, Illustrated Catalogue Mus. Comp. Zoöl., 1871, p. 20, pl. 6, figs. 8, 9, 10.
VERRILL, Amer. Jour. Sci., XXIII., 1882, pp. 316, 406 (reproduction from fragments described).
Dasmosmilia Lymani POURTALÈS, Bull. Mus. Comp. Zoöl., VI., 1880, p. 108.

This species was taken in considerable numbers by the U. S. Fish Commission Steamer Fish Hawk, in 57 fathoms, off Chesapeake Bay, 1880; off Martha's Vineyard, in 100 to 130 fathoms, 1881.

It was dredged by Mr. Pourtalès, while on the Bache, in 70 to 147 fathoms, off the Florida Reefs.

Flabellum Goodei VERRILL.

Flabellum Goodei VERRILL, Amer. Jour. Sci., XVI., 1878, p. 377; XXIII., 1882, pp. 313, 316, 407.

Plate V. Figs. 3, 4.

In life the color of the disk and tentacles is rich salmon; lips darker salmon, with stripes of dark purplish brown, or sometimes uniform madder-brown. The larger tentacles are stout, tapered, subacute.

This species has been taken in large numbers, but in most cases badly crushed, by the U. S. Fish Commission Steamer Fish Hawk, off Nantucket and Martha's Vineyard, in 219 to 780 fathoms, and off Chesapeake Bay, in 300 fathoms, 1880 to 1882.

It was first obtained by the Gloucester halibut fishermen in deep water off Newfoundland and Nova Scotia, in 180 to 400 fathoms, 1878. Several additional specimens, from that region, have since been presented by them to the U. S. Fish Commission.

This species is very closely related to *Flabellum alabastrum* Moseley,* dredged by the Challenger Expedition, off the Azores. The latter has been identified by Lindström (Actinology of the Atlantic Ocean, p. 12) with the *Ulocyathus arcticus* Sars, and the fossil *Phyllodes laciniatum* Philippi.

Our species grows to very large size; some specimens are 120 mm. long, 43 mm. broad, 80 mm. high.

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* Proc. Royal Soc. London, 1876, p. 555; and Zoölogy of the Voyage of the Challenger, Part VII. Report on the Corals, 1881, p. 169, pl. 7, figs. 1–2 b, pl. 16, fig. 11.

Flabellum angulare Moseley.

Proc. Royal Soc. London, p. 556; Voyage of the Challenger, Part VII. Report on the Corals, 1881, p. 164, pl. 6, figs. 2, 2 a, 2 b.

This species was taken by the Challenger Expedition, off Nova Scotia, in 1250 fathoms.

Deltocyathus Italicus.

Deltocyathus Agassizii Pourtalès, Bull. Mus. Comp. Zoöl., 1867, Vol. I. p. 113; Illust. Cat. Mus. Comp. Zoöl., No. IV. Deep-Sea Corals, 1871, p. 15, pl. 2, figs. 1–5, pl. 5, figs. 9, 10; No. VIII. Hassler Exp., 1874, p. 35, pl. 6, fig. 11.
Verrill, Amer. Jour. Sci., VII., 1874, p. 410.
Lindström, Contr. to Actinology of the Atlantic Ocean, 1877, p. 10, pls. 1, 2, figs. 13–20.
Deltocyathus Italicus Duncan, Trans. Zoöl. Soc. London, Vol. VIII.
Pourtalès, Bull. Mus. Comp. Zoöl., 1880, Vol. VI. p. 101, pl. 1, figs. 1–8.
Moseley, Voyage of the Challenger, Deep-Sea Corals, 1881, p. 145 (woodcuts).

Two specimens of this species were taken by the U. S. Fish Commission, off Cape Cod, in 142 fathoms, Station 36, 1873. It has been taken in numerous localities off Florida and among the West India Islands, in 73 to 878 fathoms, by the Bache and the Blake. It was also taken by the Porcupine Expedition, off the coast of Europe; by the Josephine Expedition, off Villa Franca, Azores, and on Josephine Bank, in 110 to 600 fathoms; by the Challenger Expedition, off the Azores and Bermuda, in 1000 to 1075 fathoms, off Pernambuco, Brazil, in 675 fathoms, and in the South Pacific, in 2375 fathoms.

This is an exceedingly variable species. The living forms have been identified by Duncan, and by Pourtalès, in his last paper, with the fossil species, *Deltocyathus Italicus*, from the Italian tertiaries.

Bathyactis symmetrica Moseley.

Fungia symmetrica Pourtalès, Deep-Sea Corals, p. 46, pl. 7, figs. 5, 6; Hassler Expedition, 1874, p. 43;
Bathyactis symmetrica Moseley, Zoöl. Voyage Challenger, Part VII., 1881, p. 186, pl. 11, figs. 1–13, 1 a – 13 a.
Verrill, Amer. Jour. Sci., XIII., 1882, p. 313.
? *Fungiacyathus fragilis* M. Sars in G. O. Sars, Remarkable Forms of Animal Life, I., 1872, p. 58, pl. 5, figs. 24–32.

Numerous broken specimens of this very fragile coral were dredged by the U. S. Fish Commission, off Martha's Vineyard, at Stations 879, 880, 895, in

225–252 fathoms, 1880. Some of these specimens must have been at least 20 mm. in diameter. They agree in all respects with the larger specimens figured by Moseley.

This coral is remarkable for having a wider range, in depth and geographically, than any other known species. It was first taken by Pourtalès, off Florida, in 350 and 450 fathoms, on the Bache; and in 100 fathoms, off Barbados, on the Hassler. By the Challenger it was taken in the North Atlantic, off the Azores and off Bermuda, in 32 to 1075 fathoms; in the South Atlantic, in 1900 to 2650 fathoms; in the South Indian Ocean, in 1600 to 1950 fathoms; in the Malay Archipelago and West Pacific, in 360 to 2440 fathoms; east of Japan, in 2300 to 2900 fathoms; off Valparaiso, in 1375 fathoms. Studer also records it from the Pacific Ocean.

The *Fungiacyathus fragilis* of Sars closely resembles this coral, but according to the figures its septa are not united into groups, nor are there any transverse lissepiments nor trabiculæ in the four specimens described, although some of them were larger than many of the specimens of *Bathyactis*, in which these characters are well marked. A larger series of the arctic form may, however, serve to unite them hereafter.

JULY, 1883.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Distichoptilum gracile* V. Stem and lower part of rachis, seen edgewise. Enlarged $1\frac{1}{2}$ times.

" 1 a. The same. Terminal portion. Enlarged 2 diameters.

" 1 b. The same. Spicula: *c*, one of the larger oblong forms from a calicle; *d*, two from the stalk. Enlarged 75 diameters.

" 2. *Pennatula aculeata.* Side view of a medium-sized specimen. Natural size.

" 2 a. The same. Two of the polyps expanded. Drawn from a living example. Enlarged about 6 diameters.

" 3. *Balticina Finmarchica.* Front view of the lower part of the rachis of a small example, showing, below, the imperfectly developed polyps in nearly simple series. Enlarged 2 diameters.

" 3 a. The same. One of the mature polyps expanded. Drawn from a living example. Enlarged about 8 diameters.

" 4. *Funiculina armata* V. Portion of the middle of a large example. Natural size.

" 4 a. The same. One of the spicules of the calicles. Enlarged 75 diameters.

" 4 b. The same. Portion of a younger example. Natural size.

" 5. *Kophobelemnon scabrum* V. Front view of the type-specimen, in alcohol. Enlarged 2 diameters.

" 5 a. The same. Back side.

" 5 b. The same. Two of the spicula from the upper part of the stem: *d*, one of the longer and nearly smooth prismatic spicula; *e*, one of the smaller warted spicula. Enlarged 150 diameters.

" 5 c. The same. One of the larger, warted fusiform spicula, from the same part. Enlarged 250 diameters.

" 6. *Anthoptilum grandiflorum* V. Portion showing two rows of polyps from the middle region, side view; *a*, *a*, zoöids. Drawn from an alcoholic example. Natural size.

" 7, 8. *Anthomastus grandiflorus* V. Two small-sized examples, showing different forms of the peduncle and root-like lobes. Natural size.

" 9. The same. A very young example, with expanded polyps, natural size.

" 10. The same. A young example, with the polyps nearly retracted. Natural size.

" 10 a. The same. Spicula from the outer part of the cœnenchyma: *c*, one of the longest warty fusiform spicula; *d*, one of the small rough doubleheads. Enlarged 150 diameters.

Fig. 10 b. The same. Spicula from the inner part of the cœnenchyma: *e*, one of the short rough spicula; *f*, one of the club-shaped forms; *g*, one of the larger fusiform spicula. Enlarged 150 diameters.

PLATE II.

Fig. 1. *Stenogorgia casta* V. Part of a specimen. Natural size.
" 1 a. The same. Part of a branch. Enlarged 4 diameters.
" 1 b. The same. Spicula: *c*, *d*, longer and shorter fusiform spicula; *e*, a slender fusiform spiculum from the polyps. Enlarged 75 diameters.
" 2. *Primnoa Pourtalesii* V. One of the branches. Natural size.
" 2 a. The same. Two of the calicles. Enlarged 24 diameters.
" 2 b, 2 c. The same. Two of the scales from the sides of the calicles. Enlarged 75 diameters.
" 2 d. One of the opercular scales. Enlarged 75 diameters.
" 2 e. One of the scales of the cœnenchyma. Enlarged 75 diameters.
" 3. *Eunicella gracilis* V. Part of a branch. Enlarged 4 diameters
a, one of the club-shaped spicula of the external layer; *b*, one of the long fusiform spicula of the cœnenchyma, inner portion; *c*, one of the double-headed forms. Enlarged 150 diameters.
" 4. *Dasygorgia Agassizii* V. A segment of the stem with a branch. Enlarged 2 diameters.
" 4 a. The same. One of the calicles. Enlarged 24 diameters.
" 4 b. The same. Spicula. Enlarged 150 diameters.
" 5. *Dasygorgia spiculosa* V. One of the terminal calicles with the distal part of a branchlet showing the great development of the spicula. Enlarged 12 diameters.
" 6. *Chrysogorgia Desbonni* D. & M. One of the calicles from a West Indian example. Enlarged 12 diameters.
" 6 a, 6 b. The same. Two of the spicula of the cœnenchyma. Enlarged 75 diameters.
" 7. *Iridogorgia Pourtalesii* V. One of the calicles and segment of a branch from the proximal portion. Enlarged 6 diameters.
" 7 a. The same. Two of the largest spicula of the calicles. Enlarged 50 diameters.

PLATE III.

Figs. 1, 1 a, 1 b. *Acanthogorgia armata* V. Three branches, all from the same specimen, showing the extreme variations in the form of the calicles. Enlarged 4 diameters. From an alcoholic specimen.
" 2. The same. Terminal branches of a normal specimen. About one half natural size.
" 2 a. The same. One of the calicles, from a dried specimen. Enlarged 4 diameters.
" 2 b. The same. Spicula: *c*, *d*, *e*, spines from the margin and upper part of the calicles; *f*, *g*, two fusiform spicula from the cœnenchyma. Enlarged 22 diameters.

Fig. 3. *Paramuricea grandis* V. Part of a branch. Enlarged 4 diameters.

" 3 a. The same. Spicula: *c*, *d*, spinose spicula from the margin of the calicles; *i*, *j*, *k*, flattened irregular spicula from the cœnenchyma; *h*, one of the curved or bow-shaped spicula from the bases of the tentacles; *g*, one of the fusiform spicula from the stem of a tentacle. Enlarged 40 diameters.

" 3 b. The same. One of the spicula from the tentacles. Enlarged 75 diameters.

" 4. *Paramuricea borealis* V. Terminal branch and branchlet. Enlarged 2 diameters. From a dried specimen.

" 5. The same. One of the calicles from the original type-specimen (dry). Enlarged 8 diameters.

" 5 a. The same. Spicula: *c*, *d*, *e*, spinous spicula from around the margin of the calicles; *g*, one of the irregular flattened spicula from the calicles; *f*, one of the transverse, bow-shaped spicula from the bases of the tentacles. Enlarged 40 diameters.

" 5 a′. The same. Spicula from the cœnenchyma: *i*, one of the small warted spicula; *j*, *k*, *l*, irregular and bent forms. Enlarged 40 diameters.

" 6. *Gersemia longiflora* V. One of the branches. Natural size. From the alcoholic example.

" 6 a. The same. One of the calicles. Enlarged 4 diameters.

" 6 b. The same. Spicula: *c*, *d*, *e*, oblong and fusiform; *f*, *g*, compound forms.

PLATE IV.

Fig. 1. *Lepidisis caryophyllia* V. Lower portion of the stalk, with the root-like basal lobes. Natural size.

" 1 a. The same. Portion of the stem with three calicles, from an alcoholic specimen. Enlarged 4 diameters.

" 1 b. The same. Proximal end of one of the large spine-like spicula of the calicles. Enlarged 75 diameters.

" 1 b′. The same. Spicula of the calicles: *d*, one of the large marginal spines; *e*, a marginal or submarginal spine with the tip less projecting; *f*, one of the small lateral spicula; *g*, *h*, *i*, small spicula from the tentacles. Enlarged 22 diameters.

" 1 c. The same. Scale-like spicula of the cœnenchyma. Enlarged 75 diameters.

" 2. *Acanella Normani* V. Part of the denuded axis, to show the mode of branching. Natural size.

" 2 a. The same. Four calicles at the end of a branch, from life. Enlarged 4 diameters.

" 2 b. The same. Spicula: *c*, one of the long marginal spines of the calicles, but not of the largest size; *d*, *e*, smaller spicula found both in the calicles and cœnenchyma; *f*, one of those found in the tentacles. Enlarged 22 diameters.

" 3. *Ceratoisis ornata* V. Part of the denuded axis. Natural size.

" 3 a, 3 b. The same. Two calicles from different parts of a large alcoholic specimen from off Nova Scotia, showing the extreme variation in form.

Fig. 3 c. The same. One of the large spine-like spicula (*e*) from the margins of the calicles. Enlarged 22 diameters.

" 3 d. The same. Spicula : *f*, *g*, fusiform spicula found in the calicles and cœnenchyma ; *h*, *k*, spicula with enlarged ends, from the calicles ; *i*, *j*, small spicula from the tentacles. Enlarged 22 diameters.

" 4. *Lepidisis longiflora* V. One of the calicles of an alcoholic specimen from the West Indies. Enlarged 8 diameters.

" 4 a. The same. Scale-like spicula of the cœnenchyma ; *b*, two of the larger ; *c*, two of the smaller forms. Enlarged 75 diameters.

" 5. *Acanella eburnea* (Pourt.) V. One of the calicles, from an alcoholic specimen. Enlarged 8 diameters. From a West Indian specimen.

" 6. *Anthothela grandiflora* (Sars) V. Two branches from a ramose alcoholic specimen, taken off Nova Scotia. Natural size.

" 6 a. The same. Spicula : *e*, *f*, rough fusiform spicula from the cœnenchyma ; *g*, *h*, from the calicles. Enlarged 75 diameters.

" 7. *Eunephthya Lütkeni* V. Branch of a specimen in alcohol, from off Nova Scotia. Enlarged 2 diameters.

" 7 a. The same. Spicula : *b*, one of the rough club-shaped spicula from the calicles ; *c*, *d*, rough fusiform spicula from the cœnenchyma. Enlarged 75 diameters.

PLATE V.

Fig. 1. *Actinauge longicornis* V. View of the expanded disk and tentacles, from life. One half natural size.

" 2. The same specimen. Side view in partial expansion. The dotted line shows the extent of the basal concavity. One half natural size.

Figures 1 and 2 are from one of the original type-specimens, dredged by the U. S. Fish Commission in 1880, and kept in an aquarium for several days.

" 3. *Flabellum Goodei* V. Side view of a dry and somewhat broken specimen from the fishing banks off Nova Scotia. From a photograph. Natural size.

" 4. The same. Top view of an alcohic specimen, dredged off Martha's Vineyard by the U. S. Fish Commission. Natural size.

PLATE VI.

Figs. 1 to 1 c. Three examples of *Sagartia abyssicola* V., attached to the tube (*g*) of *Hyalinœcia artifex* V., natural size ; *h*, head and anterior segments of the annelid protruded from the tube, side view ; *i*, the 32d and 33d segments of the same annelid, natural size ; *j*, caudal segments and cirri, enlarged 2 diameters ; *k*, under side of head and anterior segments of another specimen of the same annelid, natural size. These figures are mostly from alcoholic specimens, somewhat restored as to positions. From the collection of the U. S. Fish Commission.

Fig. 1 a. *Sagartia abyssicola.* Expanded.

" 1 b. The same. Partially contracted.

" 1 c. The same. Expanded and also showing the acontia (*a*) protruded from the pores (*cinclidæ*) in the sides of the body. From alcoholic specimens.

" 2. *Sagartia Acanellæ* V. Side view of a specimen covering the terminal part of a branchlet, *a*, *b*, of *Acanella.* Enlarged 2 diameters.

" 2 a. The same. Side view of a smaller, partially contracted specimen on the middle of a branchlet. Enlarged 1½ diameters. From alcoholic specimens.

" 3. *Sagartia spongicola.* Nearly vertical view of a specimen not fully expanded. Natural size, from life.

" 4. *Actinauge nexilis* V. Four contracted alcoholic specimens attached to and completely covering the distal portion of the axis of a mutilated *Balticina Finmarchica.* *a*, side view of the terminal one, showing how the basal membrane extends over the end of the axis of the *Balticina ;* *d*, basal view, showing the suture by which the edges of the basal disk unite to clasp the axis. Natural size.

" 5. The same. Top view of another less contracted alcoholic example, from the tip of a mutilated *Balticina.* Natural size.

" 6. *Actinauge nodosa.* Side view of a partially contracted, medium-sized example of the commonest or normal form, but with a bulbous base, enclosing mud. From an alcoholic specimen. One half natural size.

" 7. The same, var. *tuberculosa* V. Side view of a moderate-sized example, contracted in alcohol. Natural size. This specimen was from the fishing banks, off Nova Scotia.

" 8. The same, var. *coronata* V. Side view of a contracted alcoholic specimen, from the Blake collection. Natural size.

" 8 a. The same specimen. Top view. Enlarged 2 diameters.

". 9. *Synanthus mirabilis* V. (?) Portion of the dead axis of *Paramuricea grandis* entirely covered by the confluent individuals of this actinian. Enlarged 2 diameters. From an alcoholic example.

PLATE VII.

Fig. 1. *Urticina perdix* V. Side view of an expanded specimen, of medium size, from life. One half natural size.

" 1 a. The same. Mouth and segment of disk, with tentacles, of a larger example, from life. Natural size. These drawings were made from the original type-specimens, dredged off Martha's Vineyard by the U. S. Fish Commission, and kept alive for several weeks in aquaria.

" 2. *Actinostola callosa* V. Side view of a medium-sized example, from life. One half natural size. From a specimen dredged by the U. S. Fish Commission.

PLATE VIII.

Fig. 1. *Epizoanthus Americanus* on *Eupagurus pubescens*. Natural size. From the Gulf of Maine, 1873.

" 2. *Adamsia sociabilis* V. on *Catapagurus Sparreri* A. M.-Edw. (= *Hemipagurus socialis* Smith), drawn from life. Side view in its natural position, enlarged 2 diameters, showing the basal chitinous pellicle from which the basal disk has partially withdrawn. In this example it had a fragment of *Dentalium* for a nucleus.

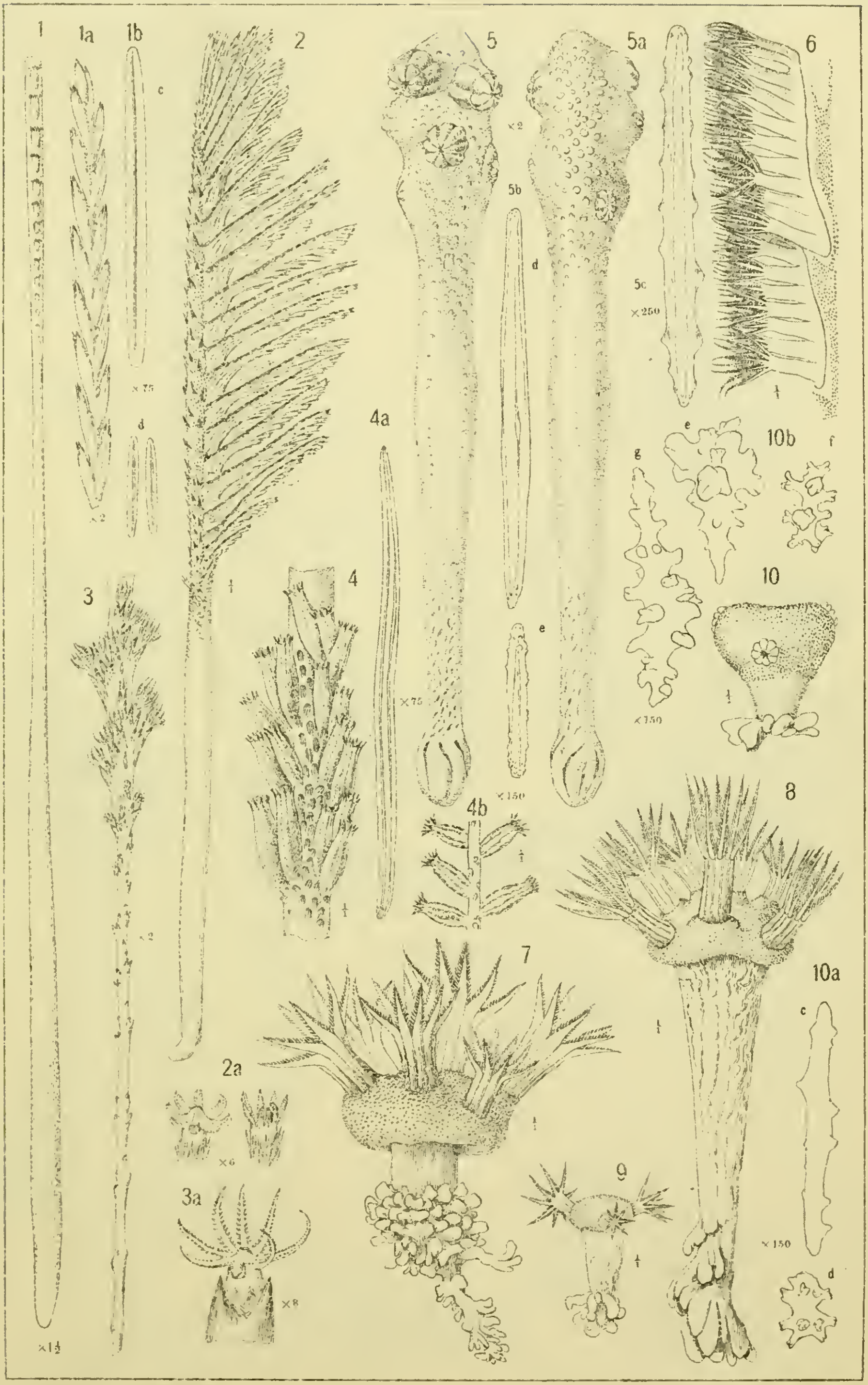
" 3. *Adamsia sociabilis* V., without the crab. Another example, seen in a posterior view, drawn from a living specimen, showing the chitinous basal secretion, which enclosed the crab, and had been partially uncovered by the contraction of the basal disk.

" 4. *Urticina consors* V. on *Sympagurus pictus* Smith. One half natural size. Drawn from the living specimens in natural positions.

" 5. *Epizoanthus paguriphilus* V., on *Parapagurus pilosimanus* Smith. Natural size. Drawn from an alcoholic specimen partially contracted.

" 6. *Epizoanthus Americanus* V., peculiar variety, on a tube of *Hyalinœcia artifex* V. Natural size.

Figures 2 to 5 are from specimens dredged off Martha's Vineyard by the U. S. Fish Commission, in 1880 and 1881. For the use of these and several other drawings of actinians made from life, I am indebted to the U. S. Fish Commission. All the drawings were made by Mr. J. H. Emerton.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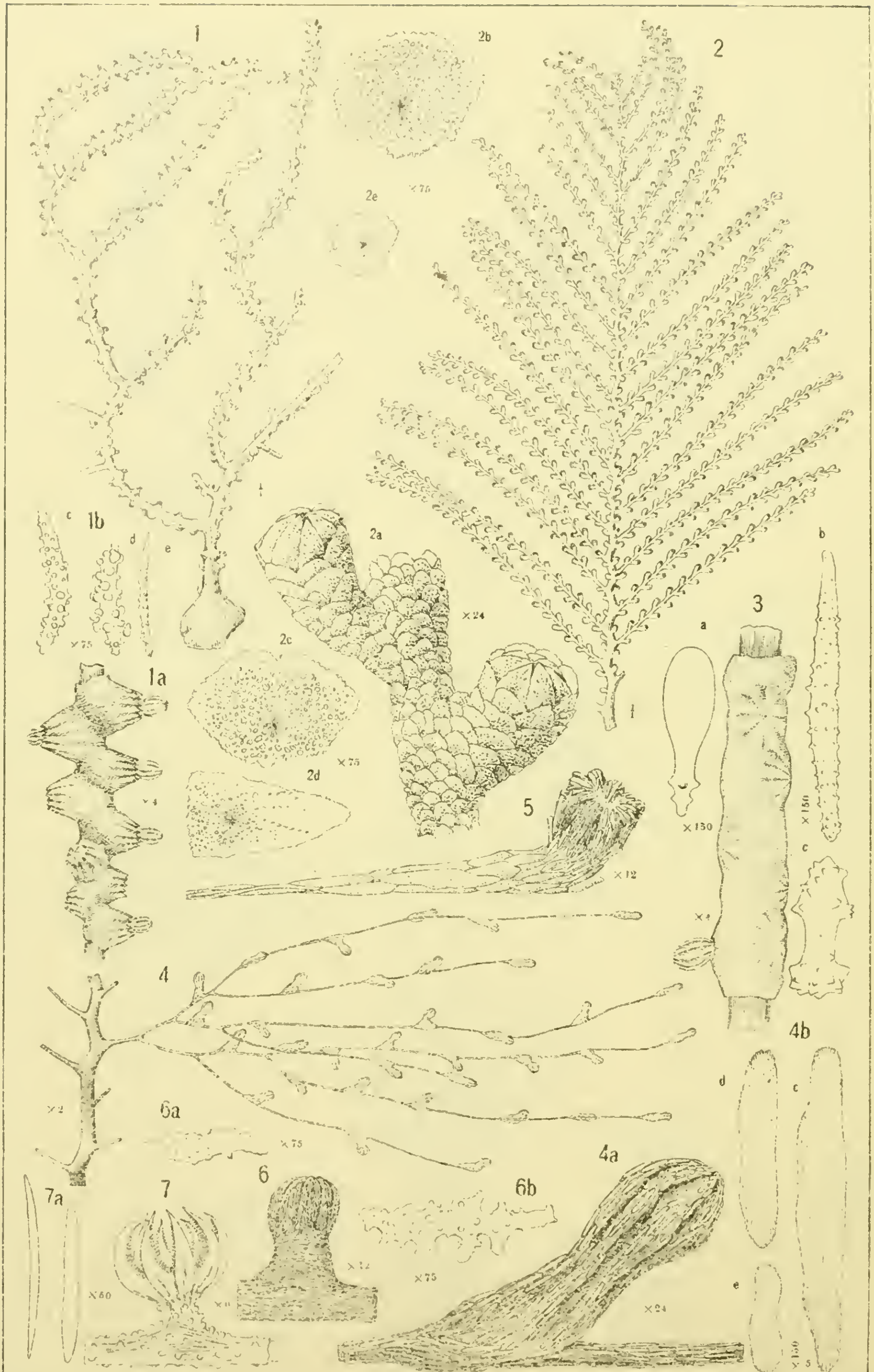
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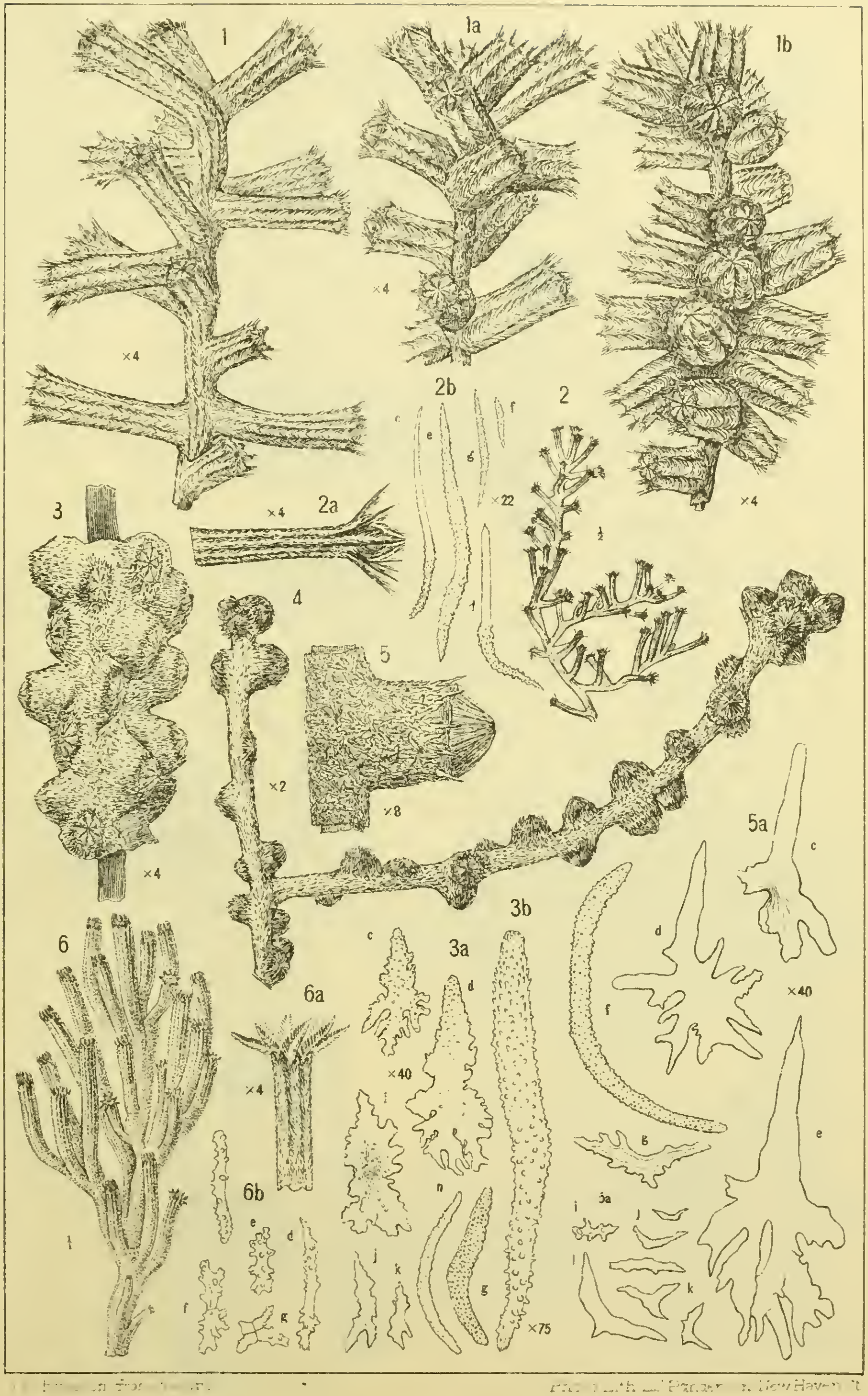
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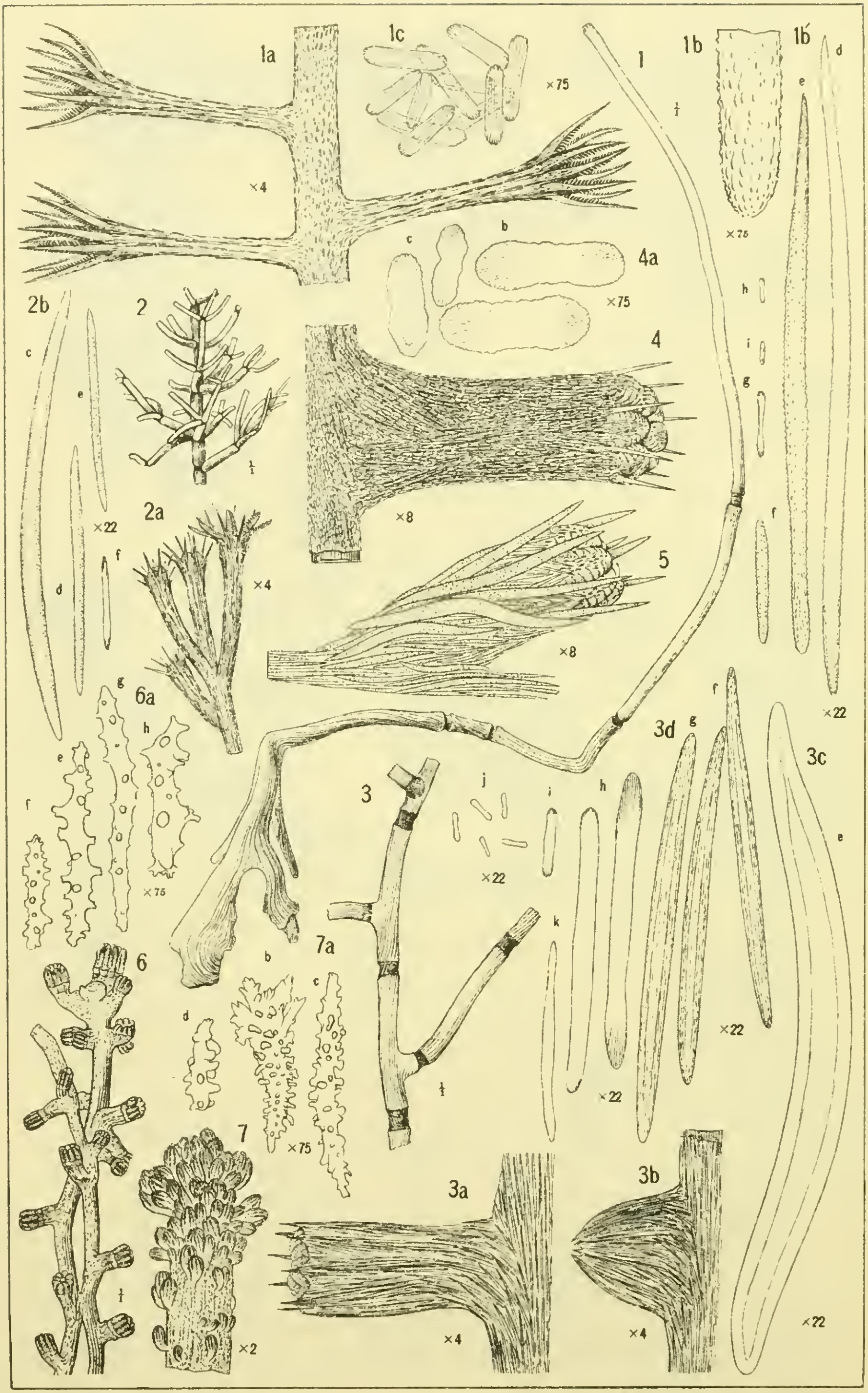
J. H. Emerton from nature. [illegible] Lith. [illegible] Punderson, New Haven, Ct.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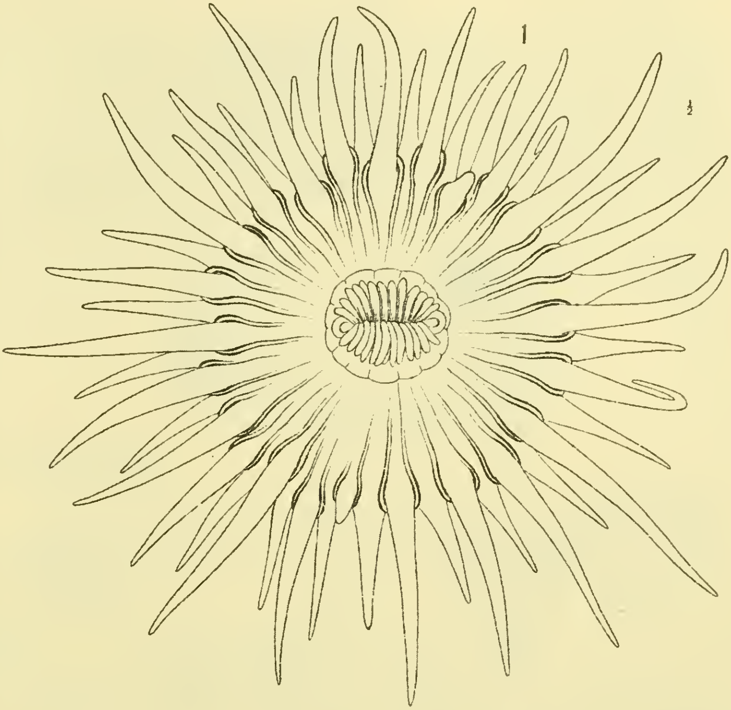

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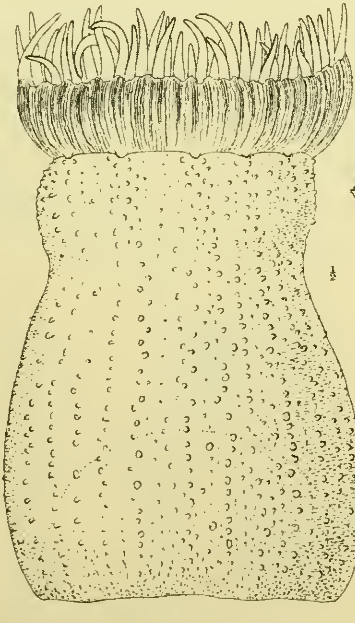

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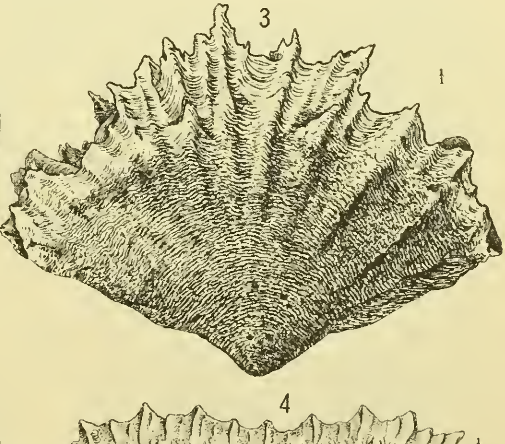

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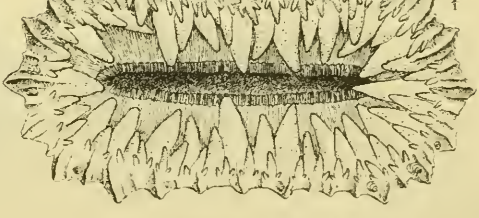
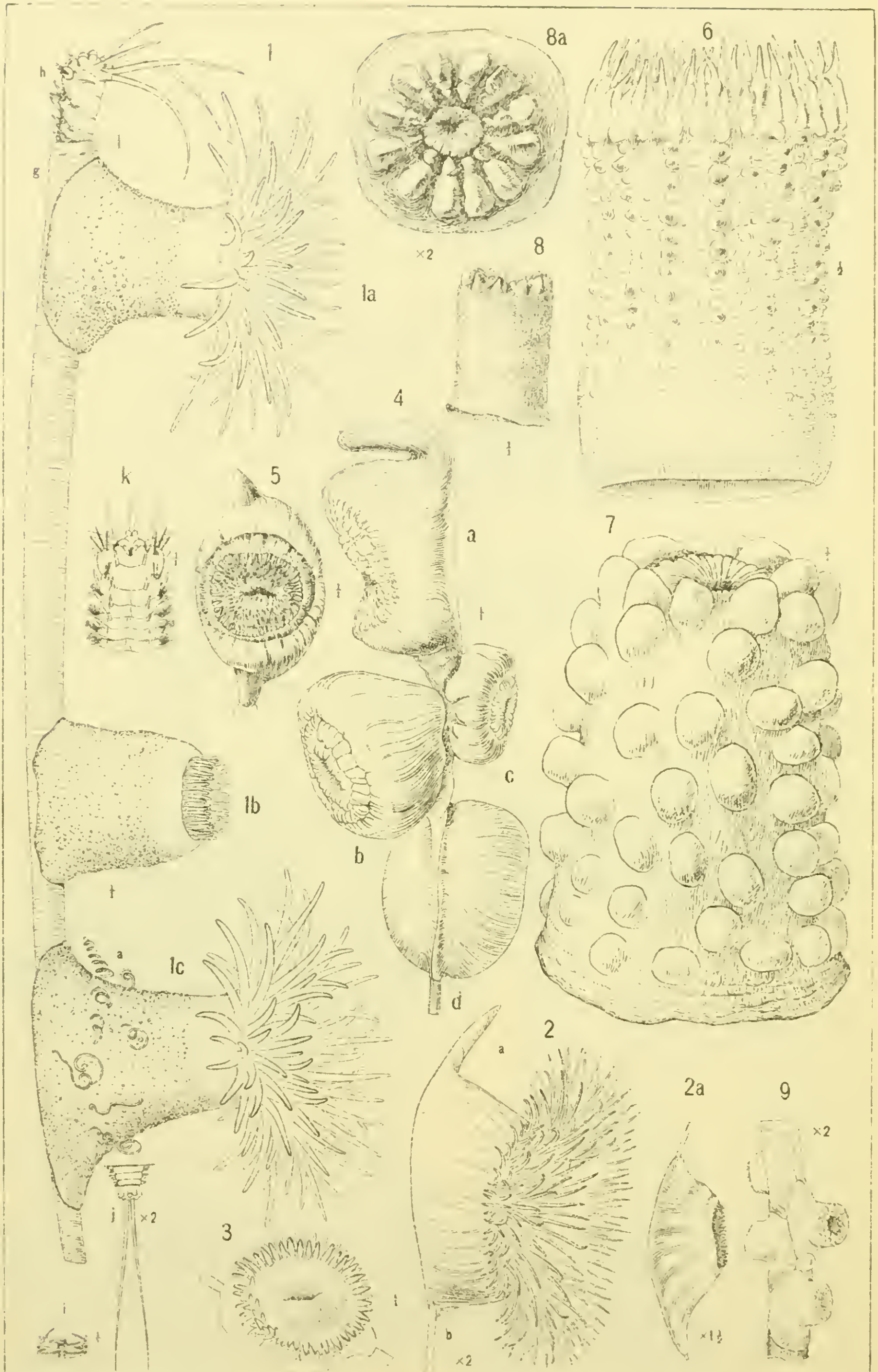


J. H. Emerton from nature

Photo Lith. Ed. Punderson, New Haven Ct.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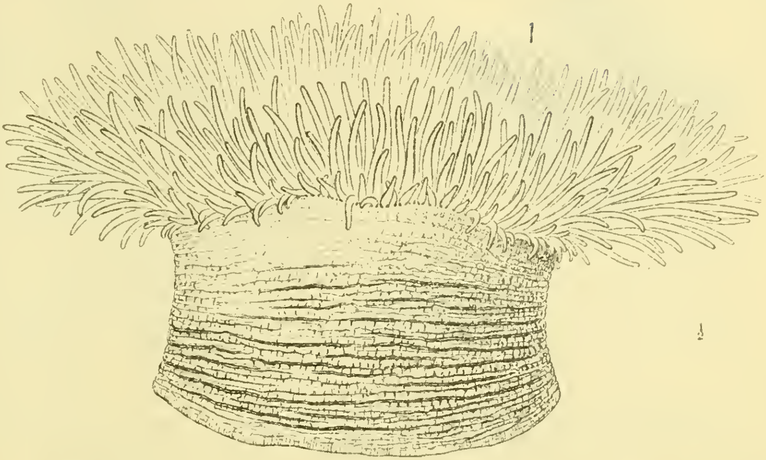

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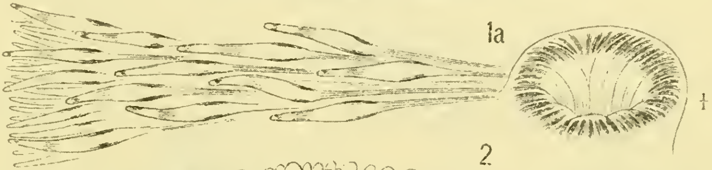

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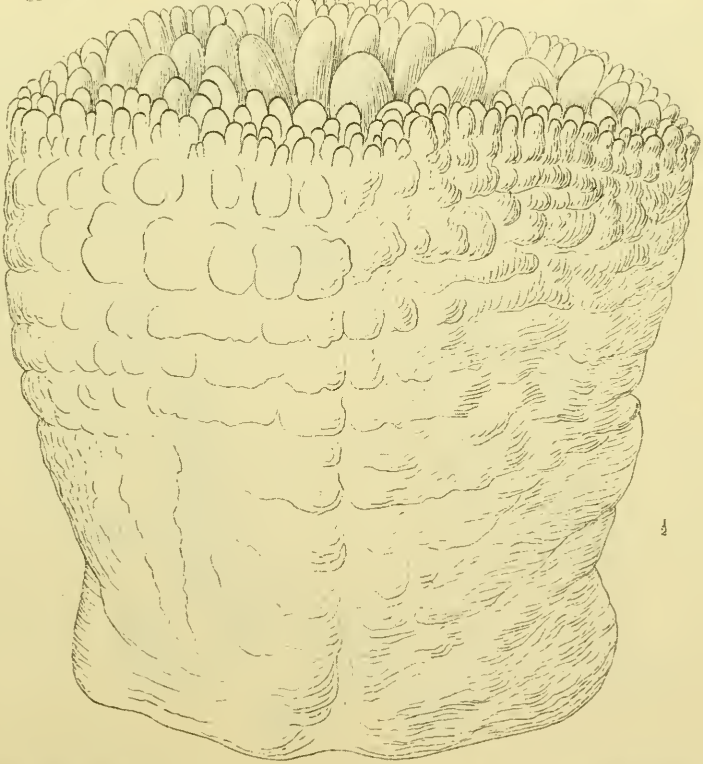

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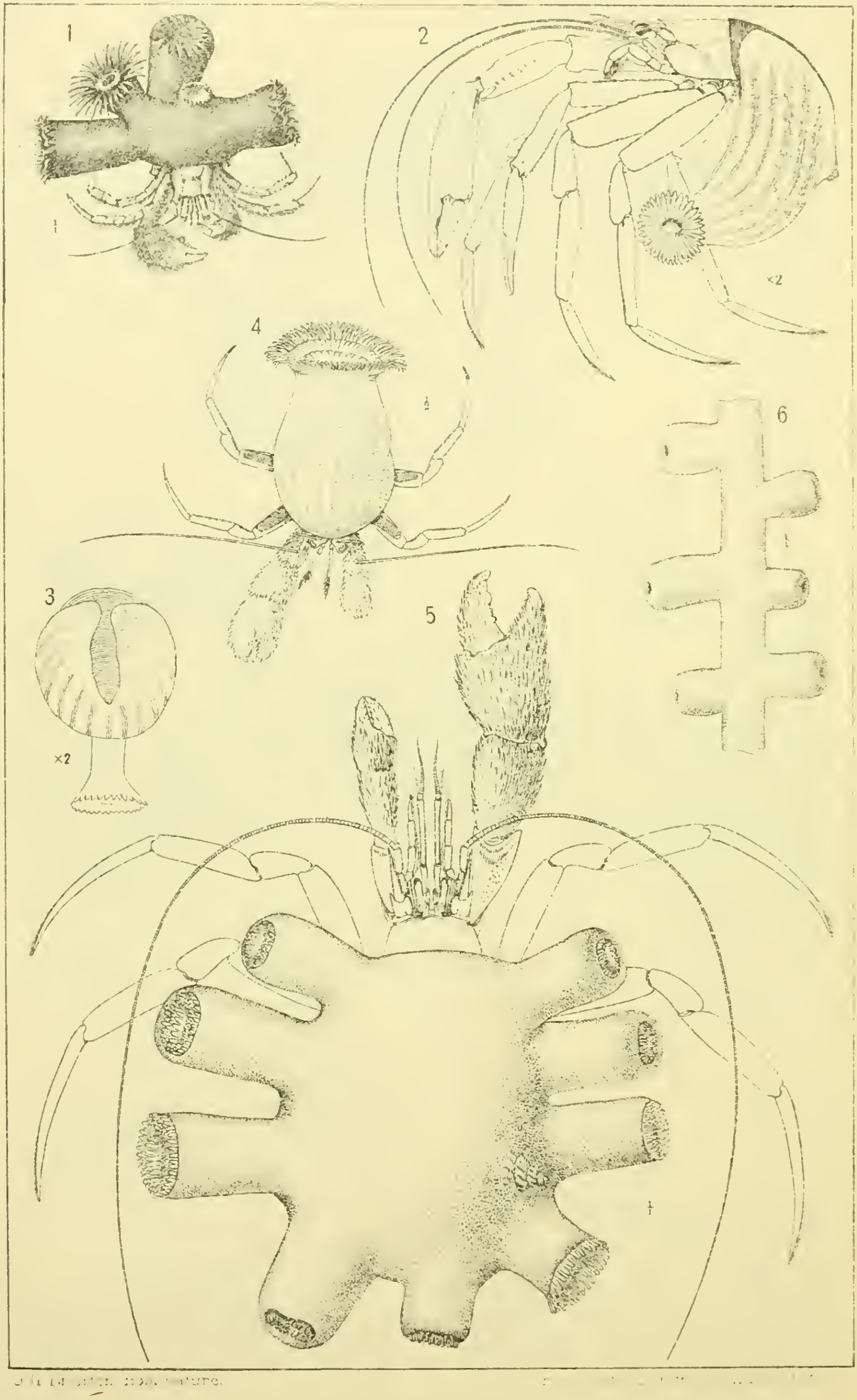
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J. H. Blake, del. ad nature.

No. 2. — *Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *along the Atlantic Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XXII.

A Chapter in the History of the Gulf Stream. By ALEXANDER AGASSIZ.

THE soundings of the "Blake" during the dredging season of 1880 developed some striking features in the profile of the slope extending eastward from the shore along the Atlantic coast, south of Cape Hatteras to the northern extremity of Florida. The soundings previously taken in deep water between the northern extremity of the Bahamas and Cape Hatteras varied greatly, and but little reliance could be placed upon them. The few lines run in 1880 normal to the coast, and the line run parallel to the so-called axis of the Gulf Stream, showed the probable existence of an immense submarine plateau extending eastward from the Atlantic shores. Either the eastern edge of this plateau was not reached in 1880, or else the soundings indicated a very gradual slope from the shore to deep water along the whole coast line south of Cape Hatteras as far as the northern part of Florida.

Everywhere else along the Atlantic coast of the United States, north of Cape Hatteras and in the Gulf of Mexico, the continental line of one hundred fathoms is most plainly marked, forming the upper edge of the more or less abrupt descent leading into deep water with a regular inclination. Owing to the absence of this hundred-fathom line south of Cape Hatteras, it became an interesting problem to trace the exact profile of that part of the coast, and to extend it into deep water. The season of 1881 was spent by Commander Bartlett in the "Blake," under the direction of the Hon. Carlile P. Patterson, the late Superintendent of the Coast Survey, in running a number of lines normal to the coast, south of Cape Hatteras and north of the Bahamas, and extending them into deep water. Commander Bartlett has sent his Report to Professor Hilgard, the Superintendent of the Coast Survey, who has kindly allowed me to make use of these results in connection with my present work on a general report of the dredging expeditions of the "Blake." The accompanying map has kindly been prepared for my use by the Superintendent of the Coast Survey.*

As was to a certain extent anticipated, the lines show the existence of an extensive plateau, of a triangular shape, reaching from the Bahamas to immediately south of Cape Hatteras, where this plateau gradually passes into the continental plateau, extending northward, which is limited by the 100 fathom line, and has a steep slope extending to deep water.

The eastern edge of this plateau is from 300 to 350 miles from the coast, and forms a gigantic submarine plateau, with an abrupt slope passing into deep water. For the sake of brevity I shall call this plateau the "Blake plateau." The eastern edge of the slope of the Blake plateau commences at an average depth of at least 400 fathoms, so that the general profile of the lines extending normally across the Blake plateau show a gradual incline from the shore to a depth of about 50 fathoms, then a somewhat abrupt slope to a depth of about 400 fathoms, then a very gradual descent to the edge of the sharp, steep slope forming the outer eastern edge of the Blake plateau, at a depth of nearly 600 fathoms.

It is interesting to speculate how this peculiar profile, so different from that of any other part of our coast, was formed. The explanation to my mind is comparatively simple. The present outer eastern edge of the Blake plateau, which is now at a depth of 600 fathoms, was at one time at a much higher level. In fact, I assume that this slope probably represents the remnant of the slope formed at the time when it began at the 100 fathom line, and that this trough with unequal sides has been worn away by the action of the Gulf Stream, wearing away the Blake plateau from a geological time which we can trace with a considerable degree of accuracy.

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* These lines have, during the season of 1882–83, been extended south of the Bahamas as far as Porto Rico. Under the direction of Professor Hilgard, the "Blake," in command of Lieutenant-Commander Browson, U. S. N., ran normals into deep water, showing that the great submarine Bahama plateau developed by Commander Bartlett commences slightly to the westward of Great Abaco, and extends thence northward, as is shown on the accompanying map. Lieutenant-Commander Browson showed further that to the south the eastern edge of the Bahama Bank extended but a short distance seaward parallel to the general line of the outer row of islands of the group, till it united with the great plateau upon which Porto Rico and the Caribbean Islands crop out, leaving probably one or two deep passages extending towards the old Bahama Channel north of San Domingo and Cuba, leading to the Windward Passage.

In other words, the old continental line extended at least 250 to 300 miles farther to the eastward, forming a huge plateau, the 100 fathom line of which extended to where the 600 fathom line now runs, and probably stretched so far south as to include the Bahamas and Cuba in this great submarine plateau. The elevation of the Blake plateau probably dates back to the end of the cretaceous period, the time when the plateau of Mexico was raised, thus cutting off whatever communication may have existed between the waters of the Atlantic and those of the Pacific, forming at the same time a number of islands, more or less extensive, in the range of the Larger and Lesser Antilles.

At that time, the Gulf Stream passing between Yucatan, then a submarine plateau of comparatively moderate depth, and Cuba, furrowed the deep channel, 1,000 fathoms or more, which now separates Yucatan from Cuba. The Gulf Stream then lost itself northward in the great Mississippi Bay, and extended fan-shaped in part over the submarine plateau of Florida. It brought, however, an accession of materials by the deposition of which the plateaus of Yucatan and of Florida were gradually built up, and which also supplied food to the innumerable marine animals whose existence is proved by the geological structure of the very plateau upon which they must have lived. The Gulf Stream thus contracted its own boundaries, and was forced into the narrower channel it had constructed between Yucatan and Cuba. As a consequence, it cut an ever deepening trough, and in proportion as Florida rose from the sea it was also compelled to find an outlet for the mass of water by which the Florida peninsula had been covered. It naturally followed the track of least resistance, and forced its way up hill over the lowest part of the plateau, the southern point of Florida, through the then comparatively shallow passage of the Straits of Bemini, which the Gulf Stream must have deepened by degrees as Florida was rising.

The mass of water which in the early part of the tertiary period forced its way north partly up the Mississippi, and east over the peninsula of Florida, was little by little confined to the single channel of the Straits of Bemini, and the whole mass of the Gulf Stream then flowed northward over the shallow plateau (the Blake plateau) extending north of the Bahamas to Cape Hatteras. It is this part of the Blake plateau which, if I am right in tracing its past history, has been worn away by the unceasing flow of the Gulf Stream.

Thus the Gulf Stream now flows north of the Straits of Bemini upon this comparatively shallow submarine Blake plateau,* of an average depth of about 450 fathoms, and finally pours into the deep water of the Atlantic over the edge of the steep slope south of Cape Hatteras. At the same time it precipitates on this slope all the silt it has carried along on its bottom, and which represents for the greater part the wearing action of the Gulf Stream in its course northward. A similar action, but on a smaller scale, also takes place on the steep western and northeastern slopes of the Yucatan Bank. The shallow surface waters of a part of the Stream pour over this bank, and deposit along the above-named slopes all the silt held in suspense, and whatever materials are picked up along its course due to its action upon the shallow banks and reefs of the great Bank itself.

We have, unfortunately, no very definite data regarding the wearing action of water charged with silt to the degree indicated by the immense quantity of it deposited by the Gulf Stream on the northeastern edge of the Blake plateau, just south of Cape Hatteras. The Mississippi, with a depth of say five fathoms, and a velocity not much greater than that of the Gulf Stream, has in a couple of years dug out a depth of at least eighty feet a short distance back of its bar. Now what may be the wearing action of a mighty river like the Gulf Stream, having perhaps an average depth of three hundred and fifty fathoms, and a breadth of some fifty to seventy-five miles, with a velocity of five miles, it is difficult to say. Supposing, however, that this wearing action is no greater than aerial denudation over the area of the Mississippi drainage basin, — that is, at the rate of one foot in six thousand years (it certainly is not too much to assume the same amount for the grinding action of the Gulf Stream), — this would give us a period of about ten millions of years since the termination of the cretaceous period. This estimate is probably far too high, judging by what we know of the wearing action of water in hydraulic sluices ; we probably have a safer estimate in a period of five millions of years as indicating the time which has elapsed since the beginning of the Tertiary. If we assume with Ramsay that this represents about one tenth of the time which has probably elapsed since life appeared on the earth, this would give us a total of not more than fifty million of years since the first appearance of life upon this globe. To this must be added as the age of the globe whatever time mathematicians think necessary to reduce the globe to a condition fit for animal life from its primitive state.

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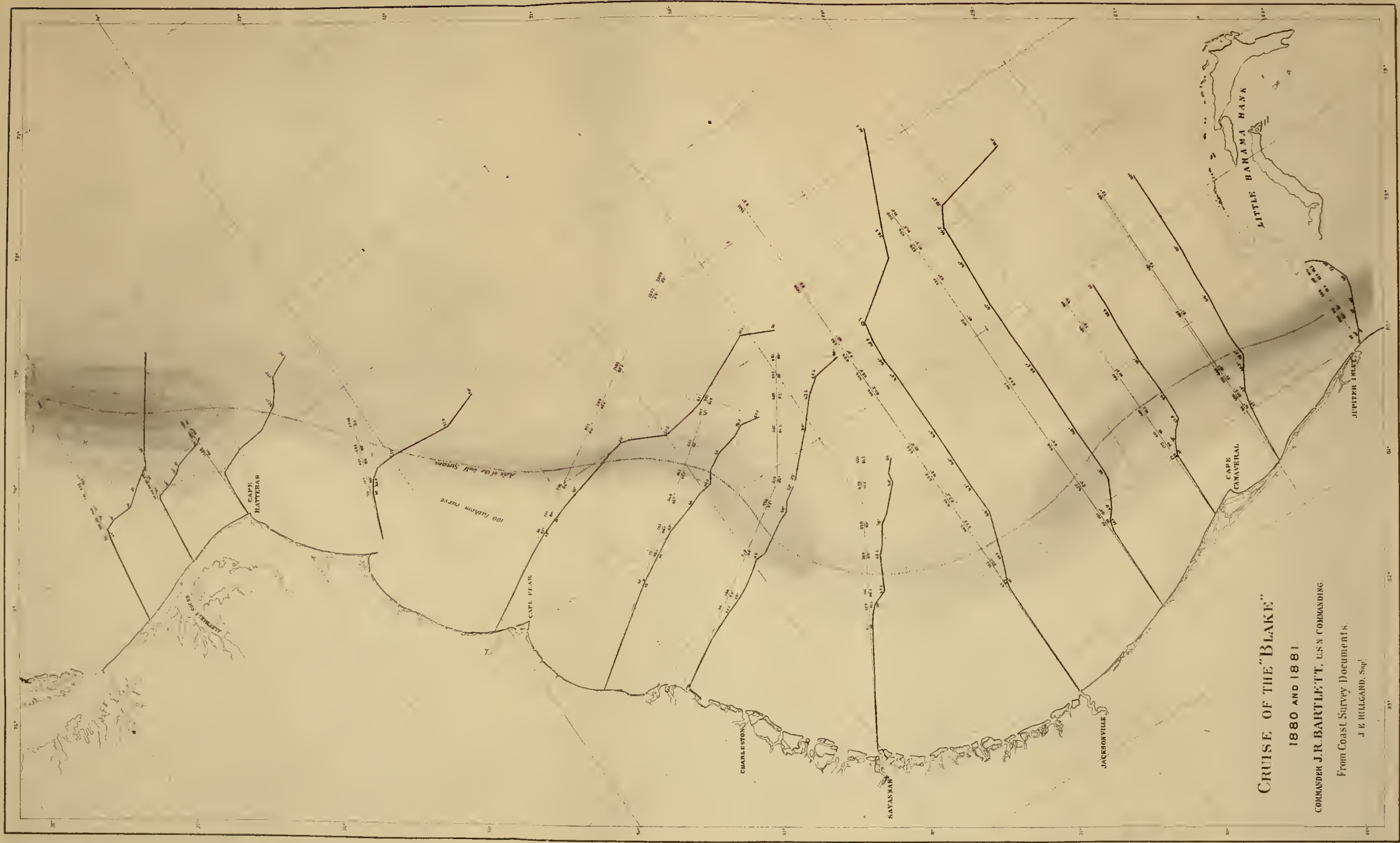
* The different shades on the map correspond with the respective velocities of 1, 2, 3, 4, and 5 knots per hour.

Cambridge, May 23, 1883.



CRUISE OF THE "BLAKE"

1880 AND 1881

COMMANDER J. R. BARTLETT, U.S.N. COMMANDING.

From Coast Survey Documents.

J. E. HILGARD, Supt.

LITTLE BAHAMA BANK
JUPITER INLET
CAPE CANAVERAL
JACKSONVILLE
SAVANNAH
CHARLESTON
CAPE FEAR
CAPE HATTERAS
ALBEMARLE SOUND
Axis of the Gulf Stream
100 fathom curve

No. 3. — *Exploration of the Surface Fauna of the Gulf Stream, under the Auspices of the United States Coast Survey, by* ALEXANDER AGASSIZ.

IV.

On a few Medusæ from the Bermudas. By J. WALTER FEWKES.

LIST OF FREE JELLY-FISHES FOUND IN CASTLE HARBOR, BERMUDA, IN MAY AND JUNE, 1882.*

Aurelia flavidula PER. et LES.
Pelagia cyanella PER. et LES.
Linerges Mercurius HAECK.
Mnemiopsis Leidyi A. AG.
Pleurobrachia rhododactyla AG.
Beroë punctata CHAM. et EYS.
Chiaja † **multicornis** M. EDW.
Physalia Arethusa TIL.
Velella mutica BOSC. (fragment).
Agalma Okenii ESCH.
Stephanomia (Forskalia) Atlantica F.
Rhizophysa filiformis LAM.
Rhizophysa Eysenhardtii GEG.
Diphyes acuminata LEUCK.
Diphyes formosa F.
Lizzia octopunctata FORBES.
Dysmorphosa fulgurans A. AG.
Halitiara formosa F.
Modeeria multitentacula F.

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* During my stay in the Bermudas very little pelagic life was seen. The above list probably contains only a small part of those jelly-fishes which frequent its waters.

† The name *Eucharis* was preoccupied in 1825, when first applied to this Ctenophore. The name is as old as 1809 among the Mollusks.

Modeeria (Turritopsis) nutricula F.
Tima formosa A. Ag.
Oceania languida A. Ag.
Eucheilota ventricularis McCr.
Cunina discoides F.
Unknown **Ephyra** with sixteen tentacles.
Tamoya punctata sp. nov.
Eucheilota quadralis sp. nov.
Oceaniopsis Bermudensis gen. et sp. nov.
Ectopleura sp.
Eucope sp.

Unknown Ephyra with sixteen tentacles.

Fig. 16.

An Ephyra, which was at first regarded as the young of *Linerges*, on closer examination was found to have sixteen instead of eight otocysts, and the same number of tentacles. In many other respects, however, it closely resembles the young *Linerges.* The bell is flat, disk-shaped, with a slightly raised and rounded apex. The marginal lappets, which are thirty-two in number, are long and flat, thin and pointed at their free extremities. When they are extended, the central region of the bell, as seen from one side, appears as a slight protuberance above the plane in which they lie. When the marginal lappets of the bell are contracted, they fold under the oral side of the bell so that their tips meet at a point in the centre below the mouth. The incisions which separate the marginal lappets of the bell extend to two depths ; one set of incisions corresponding to the position of the tentacles, and the other to that of the sense bodies. The former are the deepest, and the bell margin is cleft by them in such a way that the rim of the bell is divided into sixteen pairs of marginal lappets. The color of the bell is a brownish yellow, in which are darker spots and patches of black pigment. The mouth is simple, like that of the young *Linerges*, and from its lips hangs a single row of small papillæ, which are wanting in the Ephyra of *L. Mercurius*, Haeck. The adult of the Ephyra will certainly be found to be a very unusual Discophore. Three genera which it approximates in the number of marginal sense-bodies are *Cassiopea*, *Collaspis*, and *Atolla.* From both of the last two, however, it differs so widely in the form of the bell and other particulars that it cannot be referred to either of them. *Cassiopea*, which has sixteen otocysts, has no tentacles in the youngest larvæ studied.* The Ephyra of *Linerges* is easily distinguished from that described above, in having eight otocysts and the same number of rudimentary tentacles alternating with them on the bell margin. The marginal lappets, instead of being long and pointed, as in the above Ephyra, are rounded, and almost oval in contour. The tentacles are very short, resembling little buds in the interval alternating between the marginal bell lappets.

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* The only genus to which I have been able to refer this Ephyra is *Cassiopea. Cassiopea* (*Polyclonia*) *frondosa* is one of the most common Medusæ on the shoals along the Florida Reefs, and probably is also found in the Bermudas, although I

The youngest Ephyra of *Linerges* which was taken is much younger than any yet figured. The umbrella has a disk-like form, is flat, and has a coloration similar to that of the adult. It was not traced into a larva like that which is elsewhere* doubtfully described as the young of *L. Mercurius.*

Agalma Okenii Esch.

Several specimens of *A. Okenii* † were collected in Castle Harbor. This species has never before been taken on this side of the Atlantic. *A. Okenii* resembles our common *Agalma*, *A. elegans* F., but is easily distinguished from it by the rigid character of the body and the thickness and peculiar form of the covering-scales.

The axis in larger specimens is about three inches long, and has little flexibility. The polyp stem, or that part of the axis which bears the polypites and their covering-scales, is almost straight, and on account of the thickness and close approximation of the covering-scales is never thrown into those curves which impart so much grace to the *Agalma* when in motion. The color of the axis is yellow and orange. The float and axis resemble in most of their external features the same structures in *Agalma*. The swimming-bells are similar to those of *A. papillosum* F. in possessing blind extensions of the bell cavity into the gelatinous horns which arise on either side of the attachment to the axis and embrace the stem.

The covering-scales are very thick, and stand out at right angles to the stem at their points of attachment. In looking at the Physophore from the side, it

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was not successful in my search for it. *Cassiopea* has sixteen sense-bodies, and in that respect differs very widely from most Discophora. In one or two other genera, as *Collaspis* and *Atolla*, there are more than eight marginal sense-bodies, but the differences between these genera and the Ephyra mentioned seem too great for a reference of it to them.

If my Ephyra is in reality the young of *Cassiopea*, or some other genus with like sedentary habits, it furnishes us with the interesting fact, which I have long suspected, that in its younger larvæ *Cassiopea* is free-swimming, and has embryonic tentacles in the Ephyra which are lost in the adult.

* Bull. Mus. Comp. Zoöl., Vol. IX. No. 7.

† This species of *Agalma* closely resembles *Crystallodes rigidum* Haeck., with which it is probably identical. It seems also to be the same as a Siphonophore described by Gegenbaur, from the South Atlantic, lat. 2° S., long. 26° W. (Neue Beiträge zur näheren Kenntniss der Siphonophoren). I have followed the latter author in considering it the same as the *Agalma Okenii* described by Eschscholtz, from the North Pacific Ocean.

will be noticed that the flat faces which make up the sides of the animal below the swimming-bells are not formed, as in *A. elegans*, by the upper surfaces of the covering scales, but by planes of the same at right angles to the upper and lower surfaces of the bract. These faces are produced by the great thickness of the scale. Its breadth is simply the thickness of the distal edge of the scale. The upper surface of the lowest covering-scale is flat, and fits closely to the lower surface of that bract which is immediately above it in the series, and so on throughout the whole length of the polyp-stem to the lowest nectocalyx. The thickened border of the bract does not present, when seen from the side, a single continuous plane surface, but is made up of three or four slightly concave furrows, separated by ridges, which extend at right angles to the upper face of the scale, in the direction of the length of the stem. Both the swimming-bells and the covering-scales are infested with *Distomæ.* The appendages to the polyp-stem all arise from one side of the axis and hang downward in such a way that when the axis is extended longitudinally the free extremities of the polypites slightly protrude beyond the covering-scales. The polypites are more highly colored than those of *Agalma.* No tasters were observed. The tentacles resemble in character and origin those of *A. elegans* F. Each tentacular knob has a coiled sacculus, a well-developed involucrum within which it can be drawn, and two lateral terminal filaments, one on each side of a median vesicle. The distal extremities of the lateral filaments are slightly enlarged, and colored with reddish pigment.

NOTE.—It may be found, when older larvæ of *A. papillosum* F. are studied, that it is the same as *A. Okenii* Esch.

Rhizophysa Eysenhardtii (?) GEG.

A single specimen of *R. Eysenhardtii* (?) was taken in Castle Harbor. The species is well marked, and can easily be distinguished from *R. filiformis** by the absence of tentacular knobs on the tentacular filaments. When first taken from the water, the tentacles cling with the greatest pertinacity to whatever foreign body they touch. *R. filiformis* is also said to grasp any adjacent object in the same way; but those which I have studied do not fasten the tentacles with the same persistency as *R. Eysenhardtii.*

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* The anatomy of the above species of Bermuda *Rhizophysa* resembles closely that of *R. planestoma* Per. et Les., although in the figures of this species no side branches to the tentacles are represented. It also agrees closely in form with a species of *Rhizophysa* described by Huxley, from the Indian Ocean. In the Bermuda species no sexual clusters were found at the base of the feeding polyps, as mentioned by Huxley in his species.

Several specimens of *R. filiformis* were found at Bermuda; one of these measured over three feet in length. In this specimen the sexual bells were very large, and resemble very closely the sexual bodies of *Physalia.*

The extended axis of the specimen captured was a foot and a half long. The size of the float, as compared with the diameter of the stem, is proportionally very large, as in *Athorybia* and *Physalia*. Its apex has a crimson color, and its apical walls are broken through by a circular opening. The longitudinal axis of the float swims vertical upon the surface of the water.* Cellular appendages hang from the lower portion of the air-sac into the cavity of the float. The axis is slender, very contractile, and has a pale pink color, while that of *R. filiformis* is greenish in color. When the stem is retracted it forms a twisted snarl below the float, but at other times, when the *Rhizophysa* floats extended in the water, the tentacles and their side branches reach widely outward, and the polypites are turned at right angles to the stem. Just below the float the polypites are quite small, numerous, arise close together, and are destitute of tentacles. Their outer walls have a pale pink color, with more of an orange tinge than the axis and tentacles. The inner walls of the larger polypites bear characteristic "villi," like those described by Huxley in *Physalia*, and likewise a prominent dark brown, almost black body, which closely resembles the "liver" of *Velella*. The "villi" on the inner walls of the polypites of *Rhizophysa* are homologous with the well-known "tubes" which have been described in the liver of *Velella*. The polypites arise from all sides of the axis.

Each of the larger polypites bears a single long flexible tentacle, which is destitute of tentacular knobs, but possesses filiform side branches, which are thickly set with large cells on one side, where the tentacular walls are enlarged. While many of the side branches are claret-colored, several are colorless. When the animal is captured, the tentacles must be almost torn from objects to which they fasten themselves, before it can be raised out of the water.

The sexual organs resemble those of *R. filiformis* and *R. gracilis* F., and, like those of the former species, arise from the stem midway between two polypites. The close resemblance of the sexual clusters in *Physalia* and *Rhizophysa* has been pointed out elsewhere.† The side branches of the *Rhizophysa* tentacle are homologous with the reniform thickenings on the tentacles of *Physalia*.‡

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* The longitudinal axis of the float of *R. filiformis* lies horizontally on the surface of the water.

† Bull. Mus. Comp. Zoöl., IX. 7.

‡ The close likeness between the sexual organs in *Physalia* and *Rhizophysa* was pointed out in my description of *R. gracilis* in 1882. The comparison of the tentacular knobs in these two genera was made by Huxley (Oceanic Hydrozoa). Chun raises these two genera, *Physalia* and *Rhizophysa*, to the rank of an *order*, to which he gives the name "Pneumatophoridæ" (Pneumatophoræ), and which he regards as of equal rank with the Physophoridæ (Physophoræ) and the "Calycophoridæ" (Calycophoræ). In *Rhizophysa gracilis* F. we have a close approximation to *Physalia* in the structure of the body of the tentacle. The "sac," loose folds on one side of this organ in *Physalia*, are likewise found very well developed in the closely allied *Rhizophysa Eysenhardtii* Geg.

Tamoya punctata sp. nov.

Figs. 4–6.

A small *Tamoya*, different from any species of this genus which has yet been described was found several times at the Bermudas. It is probably the young of a species of the genus *Tamoya*, although it has differences from the known species of the genus which may later, when more is known of the development of *Tamoya*, call for its separation. The absence of enlargements of the bases of the tentacles into "wings" separates it from the adult *Tamoya*. The youngest larva (fig. 4) has the following characters. In many respects it resembles *Procharagma* Haeck., from which it however differs in the possession of a well-marked "velarium" and clusters of cells upon the external surface of the bell.

The bell of this larva has very rigid walls, as that of related Trachynemidæ. The bell walls are colorless, and without radiating chymiferous tubes. The height of the bell is a little more than its diameter. Its external surface bears parallel circles of cells, each composed of several small clusters, and arranged as shown in the figures. Instead of radial chymiferous tubes, we find four radial muscles, which extend along the inner bell walls from a point just below the apex of the bell to the marginal sense-bodies.

The proboscis is at first a bag-like fold hanging downward in the bell cavity, and slightly separated from its upper inner walls. It is a little more opaque than the adjacent bell walls, and has a reddish or brownish color. There are four short, stiff tentacles springing from the bell margin. Each is carried projecting outward, and is ribbed on its outer walls with rings of lasso-cells. The tentacles have a reddish color at their extremities.

The sense-bodies are four in number, and are set in deep incisions in the bell margin, midway between the points of origin of the tentacles. Each sense-body is covered externally by a well-developed "hood" (*h*), which is visible even in the youngest specimens. A radial muscular band passes from the base of each sense-body to the stomach, along the inner bell walls. A similar band also makes its way directly from the point of origin of the style of the sense-body into the "velarium." These last-mentioned muscles end blindly near the inner rim of this structure. Each marginal sense-body has the form of a spheroidal sac mounted on a short peduncle. This sac (otocyst) contains a solid spherical body, which occupies most of the chamber of the otocyst opposite that into which the cavity of the style opens. The otolyth is nearly transparent and colorless. There is a pair of ocelli situated in the lateral walls on the sides of each otocyst.

The "velarium" is thick, muscular, and propulsion is brought about by its strokes on the water combined with movements of the bell walls.

A second, somewhat older larva of *T. punctata* was also found. It differs primarily from that just described in the greater length of the tentacles, and in the modification in the shape of that part of the apex of the bell from which the proboscis hangs. While the proboscis of the youngest *Tamoya* springs directly from the inner wall of the bell cavity, as the larva grows older a rounded protuberance forms in the upper walls of the bell cavity from which the proboscis hangs. This protuberance, when seen from the side, is hemispherical in shape. It forms, however, by means of mesenteries which join the inner wall of the bell in the four meridians passing through the sense-bodies, four pockets, or blind cavities, enclosed by it and the inner bell walls. These pockets are extensions of the bell cavity into the apical walls of the bell, and are separated from each other on the sides by the mesenteries which join the sides of the proboscis and the inner bell walls. In these recesses transparent globules were observed in several specimens. Two of these are represented in Fig. 5.

Figs. 2, 3.

Two small jelly-fishes which are closely related to the above, or are the larvæ of a Medusa like *Tamoya*, were found on several excursions in Castle Harbor. They are slightly smaller than the youngest larvæ of the above-mentioned Acaleph, and for lack of better knowledge have been provisionally referred to *S. punctata.*

The bell walls are thin, rigid, and without chymiferous radial tubes, while the outer surface is destitute of the characteristic cells which have suggested the name *punctata.* The proboscis is very slightly developed, resembling a simple muscular layer split off from the inner walls of the bell below the apex.

The bell margin bears four tentacles alternating with as many sense-bodies, all of which are situated in one and the same plane. The four tentacles are rigid, and crossed by annulations of cells arranged in bands, as in *T. punctata.* Each otocyst is a simple spherical sac, in which is found an otolith. The style which bears the otolith has well-defined pigment spots in its walls; these are probably ocelli. No well-marked "hood," such as exists in *Tamoya*, is yet developed. Near the point of attachment of the otocyst, which has no peduncle, to the bell margin, there is a thickening of the bell margin, forming a protuberance on either side of which are small clusters of nematocysts.

Ectopleura sp.

Fig. 11.

A small Medusa, evidently larval, is referred to the genus *Ectopleura.* Unlike the young* of *E. ochracea* A. Ag., it has only two well-developed tentacles.

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* Bull. Mus. Comp. Zoöl., IX. 8. An unknown Tubularian (Fig. 14), probably larval, which was unlike any of the species of American genera, was taken at Newport during my work there last summer. Description of a single specimen: —

Bell colorless, high, with thin walls and well-marked apex, crossed by four broad radial tubes; outer surface irregularly covered with lasso-cells. The tentacles are two in number, and are placed opposite each other on the bell margin. Proboscis mounted on a hemispherical projection of the apex of the bell into the bell cavity. Stomach diminutive, lips small, smooth, slightly colored.

and these are arranged opposite each other on the bell margin. The eight rows of lasso-cells on the outer surface of the bell are similar to those in *E. ochracea*.

The youngest larva of *E. ochracea* from Newport has four tentacles. A larval *Ectopleura* with two tentacles has not been recorded previous to this observation of the Bermuda species.

Fig. 12.

The *Ectopleura* mentioned above was accompanied by several young Tubularians, all in a like stage of development, which could not be placed in any known genus. The outlines of the bell are similar to those of *Sarsia*. Its outer surface is covered with nematocysts, arranged without regularity.

The Medusa is peculiar in possessing two simple tentacles placed opposite each other on the bell rim, and a pair of small, apparently rudimentary tentacles at the extremities of the two remaining chymiferous tubes. These Medusæ are the larvæ of some unknown Tubularian related to *Sarsia*.

Oceaniopsis gen. nov.

The genus *Oceaniopsis* differs from other members of the *Oceanidæ* in possessing four octocysts, from the neighborhood of each of which, on the bell margin, there arise small tentacular filaments.

Oceaniopsis Bermudensis sp. nov.

Figs. 8, 9, 10.

Two stages in the development of this jelly-fish were found. The younger of these has two large, opposite tentacles, while the older has four.

The characters of the former (Figs. 8, 9) are as follows. The bell is low, without raised apex, with smooth external surface and thin flexible walls. There are four spherical ovaries (*s*) which hang from the chymiferous tubes midway between the proboscis and the bell margin. Two long tentacles (Fig. 8) take origin opposite each other on the bell rim. The rudiments of two others (Fig. 9) are plainly visible on the bell rim, midway between the last, as prominent projections on the bell margin. The bell bears four otocysts. From the neighborhood of each otocyst on the bell margin spring three or more, sometimes two, small filaments. No filaments are found, as in *Eucheilota*, in the neighborhood of the tentacular bulbs.

An older stage (Fig. 10) of the same Medusa has four well-developed tentacles, each of which arises from a tentacular bulb, situated at the terminus of the radial tube near the bell margin. There are no other additions of importance in this larva, which is probably not far removed in shape from that of the adult. Several larvæ of *Oceania languida* A. Ag., occurred with *Oceaniopsis*.

These invariably have eight otocysts instead of four, even before the ovaries were developed, and while there are but two tentacles which are opposite each other.

In connection with *Oceaniopsis* it may be well to mention a new species of *Eucheilota*, a young stage (Fig. 13) of which was taken in surface collecting at Newport last summer. This jelly-fish resembles closely the young of *E. ventricularis* McCr., but, unlike it, has only four otocysts. There are two tentacles, which arise diametrically opposite each other on the bell margin, at the junction of radial and circular chymiferous tubes. Near the base of each tentacular bulb there hang two short filaments, as in *Eucheilota.*

The otocysts are situated on the bell rim, half-way between the peripheral end of the radial tubes. Near each otocyst there hangs a short filament, not unlike those situated near the tentacular bulbs.

The single specimen taken was undoubtedly larval, and no indication of the sexual organs was seen. If the number of otocysts does not increase as the larva grows older, this Medusa is probably the young of a new genus; otherwise, it may be the immature form of some well-known Medusa like *Eucheilota*. Provisionally, therefore, I have referred it to *Eucheilota*, and designate it as the young of *E. quadralis* sp. nov.

Cladonema sp.

The genus *Cladonema* has up to the present time never been taken from American waters. A species of this genus, found by Dr. C. O. Whitman near Key West City, in 1883, is in certain particulars different from the *C. radiatum* Du Jardin, and may be found, on a more extended study, to be a new species.

Cladonema was found with *Cassiopea* on the shoals near Fleming's Key.* At the time of capture it was apparently at or very near the sea bottom, and was brought up in a dip-net with sand from the shoal.

The bell is almost spherical, and is destitute of an apical projection. The outer surface is smooth, and the bell walls thin. No indication could be seen, either in sketches of the animal when alive or in the preserved specimen, of a cavity at the base of the proboscis called a "brood sac" in the related genus *Dendronema.*

There are nine chymiferous tubes in the bell walls. Of these tubes, six only originate from the base of the proboscis. Three chymiferous tubes pass directly without sudivision from the proboscis to the bell margin, and three bifurcate a short distance from their origin. The three bifurcating tubes alternate with those which do not divide.

There are nine large tentacles hanging from the bell margin, each at an extremity of a chymiferous vessel. At the base of each there is an "eye-spot" of black color. Two kinds of lateral branches arise from the tentacles. The first kind hang in a small cluster from the under side of the tentacle, not far from the origin of the same from the bell margin. They are said to bear suckers at their distal ends. In the single specimen this structure could not be made out. The second kind of appendages to the tentacles are more slender than the former, and bear along their sides small lasso-cells. These branches are longer and appear more flexible than the former. The manubrium extends from its origin from the inner bell walls to the vicinity of the bell opening. The number of oral tentacles is probably five. Six small lateral projections on the outer walls of the manubrium, about midway its length, indicate the future ovaries or sexual organs.

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* A mangrove key, a short distance north of Key West, Florida.

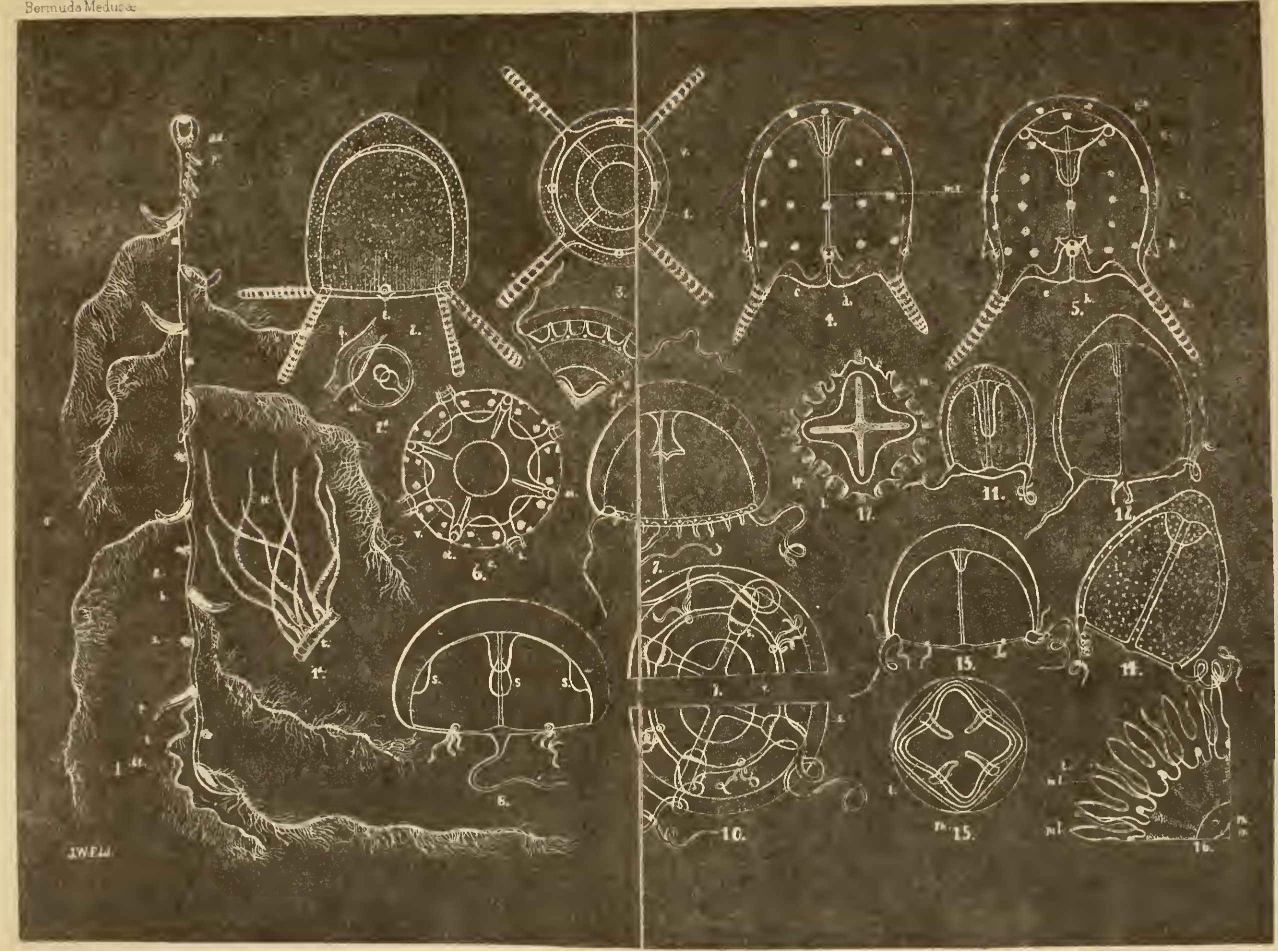
Cambridge, August, 1883.

EXPLANATION OF THE PLATE.

a.	Axis.
a a.	Float.
b.	Contents of polypite (Alga ?).
c.	"Peroniæ."
d.	Extension of bell cavity into the "velarium."
e.	Projection of the bell margin near an otocyst.
f.	Mouth (opening into a gastric cavity).
g.	Projection into the bell cavity from which the stomach hangs.
h.	Hood.
i.	Cluster of nematocysts.
k.	Annulations formed by rows of nematocysts on the tentacles.
l.	Lips.
l p.	Labial papillæ.
m.	Mouth.
m l.	Marginal lappets.
m s.	Muscular bands.
o c.	Otocyst.
p.	Polypite.
p h.	"Phacellen." Sexual filaments.
s.	Sexual organs.
t.	Tentacles.
t t.	Tentacular appendages.
v.	Velum.

Fig. 1.	*Rhizophysa Eysenhardtii* Geg.
" 1^{a}.	Portion of a tentacle of *R. Eysenhardtii.*
" 2.	Young of an unknown Medusa.
" 3.	The same from below.
" 4.	Larva of *Tamoya punctata,* sp. nov.
" 5.	Older larva of the same.
" 6.	View of *T. punctata* from below
" 7.	Larva of an unknown Tubularian.
" 7^{a}.	The same from below.
" 8.	*Oceaniopsis Bermudensis* gen. et sp. nov.
" 9.	View of half of the same from below.
" 10.	The same, from larva somewhat older.

Fig. 11. Larva of *Ectopleura* sp.
" 12. Larva of an unknown Tubularian.
" 13. *Eucheilota quadralis* sp. nov.
" 14. Larva of an unknown Tubularian.
" 15. "Phacellen" of very young *Linerges*.
" 16. Quadrant of the Ephyra of an unknown Discophore.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No. 4.—*Reports on the Results of Dredging, under the Supervision of* ALEXANDER AGASSIZ, *on the East Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* COMMANDER J. R. BARTLETT, U. S. N., Commanding.

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XXIII.

Report on the Isopoda. By OSCAR HARGER.

THE collection of Isopoda from the Blake Expedition, although small in number, is remarkable for the large proportion of interesting forms secured, since nearly all the specimens prove to belong to species that are either new, or not hitherto known from our coast, or to species known only from single specimens and hence only imperfectly described.

CIROLANIDÆ.

Cirolana spinipes BATE & WESTWOOD.

Plate I. Figs. 2-2d. Plate II. Figs. 1-1c.

Cirolana spinipes BATE & WESTWOOD, Brit. Sess. Crust., II., p. 299. 1868.

Specimens of this species, not hitherto recorded from our coast, were obtained from two localities; viz. Station 316, Lat. 32° 7′ N., Long. 78° 37′ 30″ W., 229 fathoms, one female; and Station 321, Lat. 32° 43′ 25″ N., Long. 77° 20′ 30″ W., 233 fathoms, three females and one male.

These specimens appear to agree perfectly in all specific characters with others in the collection of the Yale College Museum identified and sent to the Museum by the Rev. A. M. Norman, from the Shetland Islands. They do, however, differ in some respects from the description of that species in Bate and Westwood's work, and to facilitate comparison with that species and with others on our coast a full description is appended, with figures.

The body is a little more than three times as long as broad, with the dorsal surface strongly rounded, polished and smooth except for minute punctations, mostly near the posterior margin of each segment, and a median dorsal row of shallow oval depressions, most distinct on the third, fourth, and fifth thoracic segments.

The head is quadrate, widest across the posterior part of the eyes, which are oval, and more distinct than in the other species on our coast. A horizontal impressed line passes along the side of the head above and in front of the eye, and another just above the anterior margin over the bases of the antennæ. The antennulæ (Pl. I. Fig. 2 a) are short, not equalling the peduncle of the antennæ. Their basal segments are in contact above and in front; the second segment is short, the third as long as the first two, and is followed by a flagellum not as long as the peduncle and composed of about fourteen short and closely united segments. The antennæ (Pl. I. Fig. 2 b), when reflexed, reach the posterior margin of the third thoracic segment; the first two peduncular segments are short; the third and fourth each twice as long as the second, and of somewhat greater diameter; the fifth is the longest peduncular segment, and, at base, only about half the diameter of the fourth. The slender, tapering flagellum is about twice as long as the peduncle, and composed of twenty-five or more segments. The fourth and fifth peduncular segments bear, near their distal ends, a few slender and rather short bristles, much less conspicuous than in *C. concharum* or *C. polita* (Pl. I. Fig. 1 b), but longer than in the next species, *C. impressa* (Pl. I. Fig. 3 b).

The first thoracic segment is slightly longer than the second; posteriorly the segments increase slightly in length to the fifth or sixth, but the seventh is the shortest. The first segment is marked by an impressed curved line just above the lateral margin. The epimera of the second and third segments are small, subquadrate, rounded behind. The fourth epimeron is larger than the preceding ones, with the lower posterior angle rounded. The fifth and sixth epimera are of about equal size and larger than the others, while the seventh is the smallest of all. In the last three the posterior margin is oblique, and the lower angle is pointed. All the epimera are quadrate in general outline, and from near the middle of the line of union with the segment a sharp depressed line extends upward upon each of the last four segments.

In the first pair of legs (Pl. II. Fig. 1 a) the basis is flattened on the upper or inner side, and slightly curved in adaptation to the convex under surface of the head. The anterior margin of this segment is also fringed with bristly hairs. The succeeding segments are well armed with bristles, and the merus, carpus, and dactylus are armed along their palmar margins also with acute spines; the carpus in this leg is triangular and articulated with little motion to the propodus. The legs of the second and third pairs resemble the first, but have a free articulation between the propodus and carpus, which is oval and armed with several acute spines. These three pairs of legs are directed forward. The fourth and subsequent pairs are directed backward. The legs of the fourth pair (Pl. II. Fig. 1 b) are of moderate length and well armed with bristles or spines throughout, especially on the merus and carpus, where the spines form a striking feature. The palmar margin of both these segments is armed with a row of slender elongated spines and bristles, with many shorter spines also along the margin, while upon the outer or exposed surface of both segments is a pretty regular longitudinal row of short spines, nearly along the middle of the segment, and others in less regular order between this row of spines and the palmar border. In the English specimens these spines are even somewhat more numerous than in ours. The fifth leg is similar to the fourth, but somewhat longer and more slender, and the spines on the merus and carpus are nearly as pronounced and definitely arranged as in the fourth, while a similar arrangement is found in a less degree upon the remaining two pairs of legs. In the last two pairs of legs the bases are flattened, expanded, and well ciliated, forming strong swimming organs. One of the last pair is figured on Plate II. Fig. 1 c.

All of the pleonal segments are plainly evident above, the first not being at all concealed by the last thoracic segment, as in the other species on our coast. The first four segments are subequal in length on the median dorsal line ; laterally they are carinated, the carina ending behind in an angulation (see Pl. I. Fig. 2 c) which is most pronounced on the third segment and is rounded off on the fourth. The thickened, chitinous walls of these segments are more or less continued below the lateral keel upon the inferior surface of the pleon, and in the first two segments the inner and posterior angles of this portion are acutely produced, in the second segment, into short, divergent spiniform processes. In the third, the under part of the segment runs out to its lateral angle, and in the fourth segment this portion is small and not angulated. All these segments are smooth and not ciliated laterally. The fifth segment is small, and does not reach the lateral margin of the pleon. The last segment (Pl. II. Fig. 1) is semioval, acutish at the tip, near which it is ciliated and bears a few short spines. The basal segment of the uropod is produced at the inner angle to about half the length of the outer ramus. This ramus is lanceolate in outline, shorter than the inner, and of only about half its width ; both are ciliated and armed with short spinules. The inner is destitute of the emargination seen on the outer border near the tip in the other species. The second pair of pleopods in the male (Pl. I. Fig. 2 d) is armed, on its inner ramus, with a stylet of peculiar form. The stylet is slightly longer than the ramus and very acute at the tip, just below which it is suddenly much expanded and sends off a prong on the outer side, toward the lamella, as shown in the figure. A similar structure is seen in the male from the Shetland Islands, but I have seen nothing like it in the other American species.

Length of female, 23 mm.; breadth, 7.5 mm. The single male specimen obtained is smaller : length, 16 mm.; breadth, 5.5 mm.

Cirolana impressa sp. nov.

Plate I. Figs. 3-3d. Plate II. Figs. 3-3c.

This species closely resembles *C. polita* (Stimp.), as may be seen from the figures of the two species (Pl. I. Fig. 1, *C. polita*, Fig. 3, *C. impressa*). They are most readily distinguished by the impressed lines on the surface of the epimera in the present species, but a closer inspection brings to light other characters, as will appear in the following description.

The body is more than three times as long as broad, with the sides nearly straight and parallel, smooth and polished, with fewer punctations than in *C. polita*, but with the usual median dorsal row.

Head rounded hexagonal, broadest across the eyes, with an impressed line just above them extending around the front of the head. Eyes small, subtriangular, notched on their front outline by a thickened marginal ridge, which dies out in the ocular region. Antennulæ (Pl. I. Fig. 3 a) about as long as the peduncle of the antennæ; two basal segments swollen and together longer than the third; flagellum as long as the peduncle, composed of about a dozen segments, shorter and more closely articulated than in *C. polita*. (Pl. I. Fig. 3 b). Antennæ surpassing the margin of the first segment, shorter than in the preceding species; flagellum one half longer than the peduncle and composed of about twenty-two segments.

First thoracic segment closely adapted to the hinder margin of the head, about twice as long on the median line as the second. Behind the second, the segments gradually increase in length to the seventh, while in *C. polita* the fifth is the longest segment and the seventh is shorter than the sixth. The first segment is marked in the epimeral region by a nearly marginal impressed line. In the following segments the epimera are distinct and increase in size to the last. The second and third epimera are subquadrate, with rounded posterior angles, much as in *C. polita*, but each is marked by a curved impressed line below and somewhat behind the middle. The third and fourth epimera are also quadrate in outline, the posterior margins becoming oblique and meeting the inferior margin in each at an angle, while in *C. polita* both these epimera are rounded behind. In the present species, moreover, both these epimera are marked with an oblique impressed line running from near the middle of the upper margin toward the lower posterior angle. The last two epimera are subtriangular in outline, as in *C. polita*, and the sixth is marked with an impressed line, much as in the fourth and fifth. A similar line is faint, or represented by a row of punctations, on the last epimeron. The impressed lines on the epimera of this species serve also to distinguish it from *C. concharum* (Stimp.), to which it has considerable resemblance.

In the first pair of legs (Pl. II. Fig. 3 a) the merus is large and produced at its outer angle beyond the middle of the propodus, its palmar margin is armed with acute spinules much as in *C. polita*, but not quite as strong as in that species (Pl. II. Fig. 2 a), while it differs from *C. concharum* (Pl. II. Fig. 4 a) in lacking the row of blunt spinules near the palmar margin of this segment. The legs of the fourth pair (Pl. II. Fig. 3 b) are armed with spines, with comparatively few bristles among them, and the spines upon the surface of the merus and carpus are arranged transversely, instead of as in the last species. In the seventh pair of legs (Pl. II. Fig. 3 c) the basis is slender and nearly naked, as in *C. concharum* (Pl. II. Fig. 4 c), and the three following segments are flattened and furnished with close-set bristles distally.

The pleon (Pl. I. Fig. 3 c) is more overlapped and concealed by the last thoracic segment than in either *C. concharum* (Pl. I. Fig. 4) or *C. polita* (Pl. I.

Fig. 1 c). The first segment is quite concealed above, and the second more or less concealed also in the ordinary position of the segments. In the ventral portions of the first three pleonal segments the posterior angles are rounded instead of being acute, as in both the *C. polita* and *C. concharum;* laterally the second, third, and fourth segments are ciliated, as in both those species. The telson (Pl. II. Fig. 3) is much like that of *C. polita* (Pl. II. Fig. 2). The uropods have the basal segment produced internally; the outer ramus is about half as wide as the inner, which has a distinct notch near the distal end of the outer border and is obliquely truncate, or, in the larger specimens, emarginate at the end; both rami, like the end of the telson, are strongly ciliated, but sparingly spinulose. The telson is distinguished from that of *C. concharum* (Pl. II. Fig. 4) by the emargination at the tip in that species. The stylet on the second pair of pleopods in the male (Pl. I. Fig. 3) is simple, ensiform, and tapers to a blunt point ; it surpasses the lamella to which it is attached.

The four large females of this species obtained by the Blake Expedition measure in length 21–23 mm. and in breadth 6–6.5 mm. Specimens obtained by the U. S. Fish Commission are many of them smaller, but vary from 15 to 27 mm. in length.

The specimens were obtained at Station 336, Lat. 38° 21′ 50″ N., Long. 73° 32′ W., from a depth of 197 fathoms. Others have also been obtained by the U. S. Fish Commission at the following stations: —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
871	115	40° 2′ 24″	70° 23′ 40″	4
949	100	40° 3′	70° 31′	11
1094	301	39° 57′	69° 47′	1
1095	321	39° 55′ 28″	69° 47′	2

ÆGIDÆ.

Æga psora (Linné) Kröyer.

One specimen from 306 fathoms at Station 303 in Lat. 41° 34′ 30″ N., Long. 65° 54′ 30″ W.

? Æga Webbii (Guérin) Schiödte & Meinert.

Pterelas Webbii Guérin, Mag. Zoöl., Classe VII., Pl. XX. 1836.
Æga Webbii Schiödte & Meinert, Naturhist. Tidssk., R. III., B. XII., p. 347. Pl. X. (Cym. IV.) Figs. 1–4. 1879.

A single immature specimen of this, or a closely allied species, was taken at Station 307, Lat. 31° 57′ N., Long. 78° 18′ 35″ W., from a depth of 333 fathoms. It measures 10.5 mm. in length, 5.5 mm. in breadth, and has not yet developed the seventh pair of legs, but the propodi of the second and third pair of legs are armed with the characteristic cultriform spine, and I have referred it to this species, though not with certainty.

Æga incisa Schiödte & Meinert.

Plate III. Fig. 1.

Æga incisa Schiödte & Meinert, Naturhist. Tidssk., R. III., B. XII., p. 373, Pl. X. (Cym. IV.) Figs. 13–15. 1879.

A single specimen, apparently of this species, was taken at Station 307, from a depth of 333 fathoms, in Lat. 31° 57′ N., Long. 78° 18′ 35″ W.

It agrees so closely with Schiödte and Meinert's description that I have little doubt of its identity with that Mediterranean species, although the body is proportionally narrower and the segments of the pleon more regularly curved above than represented in the figure of *Æ. incisa* given by those authors.

In our specimen the body is nearly three times as long as broad, sparingly punctate, well rounded above.

The head is rounded behind, presenting no ocular lobes; in front it is produced into a distinct, pointed process projecting downward between the bases of the antennulæ, separating them and nearly touching the frontal lamina, which is small and rhomboidal. The first two segments of the antennulæ are short and small, and rounded in front, not enlarged as in *Æ. psora* Kröyer; the third segment is longer than the first two, and is followed by a slender flagellum, longer than the peduncle, composed of about fifteen segments, of which the first is the longest, being as long as the next two, instead of "quam secundo paulo longiore," as in the typical specimen of the species. The antennæ, when reflexed, surpass the second thoracic segment; the flagellum is longer than the peduncle, and composed of less than twenty segments.

The eyes are large, and meet broadly on the median line; ocelli in about ten horizontal rows, half of which meet on the median line in front.

The first thoracic segment is longer than the second, thence they increase slowly in length to the fifth or sixth, and the seventh is short. The epimeral region of the first segment is marked by an obliquely descending depressed line. The epimera are all angulated behind, though only the last two are sensibly produced, and all are marked by one or two oblique curved lines, running downward and backward, the posterior one ending in the lower angle. The last epimeron does not attain the lateral angle of the first segment of the pleon. The legs are weak, and armed with but few small and short spinules throughout.

All the segments of the pleon are evident, but the first is very short above; the first four are distinctly angulated laterally. The telson is subtriangular, distinctly notched behind, as well as minutely crenulated and spinulose. The basal segment of the uropods is produced internally about half the length of the inner ramus, which is obliquely elongate triangular, larger and broader than the narrowly ovate outer one; both are ciliated and minutely denticulate.

Length, 13.5 mm.; breadth, 5 mm.

I have seen no other specimens.

Rocinela oculata sp. nov.

Plate III. Figs. 2-2a. Plate IV. Fig. 1.

Body oval, length a little more than twice the breadth, surface sparsely punctate.

Head subreniform, produced in front into a truncated process over the bases of the antennulæ, yoke-shaped behind, the ocular lobes projecting, upper surface nearly covered with the large eyes in which the ocelli are large and quincuncially arranged in ten rows along the long axis of each eye. Five of these rows meet along the median line.

The antennulæ are slender and scarcely attain the tip of the antennal peduncle; the basal segment is short and concealed from above; the second is longer than the first; the third is slender, but not as long as the first two together; flagellum about as long as the peduncle, slender and composed of five segments, of which the first is much the longest and the last is the shortest, and does not quite attain the posterior border of the eye when the antennula is reflexed. The antennæ surpass the first thoracic segment; the first two segments are very short; the flagellum is about twelve-jointed.

First thoracic segment closely adapted to the head in front; fourth segment longest on the median line above; sixth short; seventh nearly concealed and quite small, although bearing a well-developed pair of legs below.

The epimera of the second and third segments are oblique, but not acute nor produced backward in a lateral view; in the four following segments they are produced and very acute; the seventh epimeron is much smaller than the sixth, and, owing to the shortness of the seventh segment, ends behind about on a line with it, both epimera surpassing the first segment of the pleon.

Legs of the first pair (Pl. IV. Fig. 1) slender, armed with a long slender dactylus, much curved near its base; propodus expanded with a large palmar lobe armed with a marginal row of eight curved spines; carpus short, with a single curved palmar spine. Legs of the second and third pair much like the first, but with only six spines on the propodus. Legs of the fourth and posterior pairs slender, armed with spines principally at the distal ends of the ischium, merus, and carpus.

First segment of pleon very short and nearly concealed by the thoracic segments, narrower than the next three segments, which are about equal, acutely produced at the sides so as to resemble in shape the seventh epimeron; fifth segment narrower than fourth, but somewhat longer on the median line; telson semi-oval, regularly rounded behind and ciliated. Uropods equalling the telson; inner angle of basal segment produced, about one third the length of the inner ramus, which is ligulate, rounded behind, slightly shorter than the outer, and less than half as broad; outer ramus obovate, spinulose along the outer border; both rami ciliated except near the base.

Length, 13.5 mm.; breadth, 6 mm.

A single specimen of this species, the only one as yet known, was taken at Station 305, Lat. 32° 18′ 20″ N., Long. 78° 43′ W., from a depth of 252 fathoms.

Rocinela Americana Schiödte & Meinert.

Plate III. Figs. 3, 3 a, 4. Plate IV. Figs. 2, 2 a.

Rocinela Americana Schiödte & Meinert, Naturhist. Tidssk., R. III., B. XII., p. 394, Pl. X. (Cym. IV.) Figs. 16–18. 1879.

Two specimens of this species were obtained at Station 320, Lat. 32° 33′ 15″ N., Long. 77° 30′ 10″ W., from a depth of 257 fathoms, and a considerable number of other specimens obtained at various localities by the U. S. Fish Commission enable me to add somewhat to Schiödte and Meinert's description of the species, which was drawn from a single female specimen. A comparison of their type, from Trenton,* Maine, now preserved in the Museum of Comparative Zoölogy at Cambridge, and kindly loaned for the purpose by Professor Agassiz, shows no differences that can be regarded as specific.

The body is oval, with the length more than twice the breadth, and nearly all of our specimens are proportionally broader than the type, although none of them are quite as large.

Head subtriangular, rounded behind, acutish or slightly produced in front, more distinctly produced and somewhat angulated in front in the males (Pl. III. Fig. 4). Eyes rather large, separated by about one quarter the diameter of the head, rounded behind, more or less angulated at the point of nearest approach, where, in the males, a distinct angle of a hexagon is seen at the meeting of two rows of nine and six ocelli along the inner margin of the eye, one ocellus at the angle being common to both rows.

The antennulæ, when reflexed, only slightly surpass the head, and the flagellum is composed of five or six segments, of which the first is not much elongated and the last nearly attains the end of the antennal peduncle. The antennæ nearly attain the hinder margin of the second thoracic segment; the first and second segments are very short and concealed by the projecting front; the flagellum is as long as the peduncle, and composed of about fourteen segments.

The first thoracic segment is slightly excavated for the ocular lobes of the head; epimera of second and third segments subquadrate, oblique but not acute behind, marked with an impressed line near the lower margin; remaining four epimera acute and moderately produced; last epimeron usually surpassing the first segment of the pleon, although in some of the larger females, as in the type specimen, it fails to do so.

Prehensile legs (Pl. IV. Fig. 2) armed with three acute spines on the palmar margin of the propodus, and three obtuse spines on the same margin of the merus; carpus short. Ambulatory legs (Pl. IV. Fig. 2 a), well armed with spines.

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* Trenton is incorrectly printed "Ireston" in Schiödte and Meinert's paper.

First segment of pleon small, nearly concealed by the last thoracic segment, and usually surpassed by the last pair of epimera, narrower than the three following segments, which are slightly broader than the last thoracic segment without the epimera. Last segment broader than long, rounded and ciliated behind, faintly furrowed on the median line posteriorly. Uropods about equal to the telson; basal segment more or less produced at the internal angle, outer ramus shorter than the inner, both rounded behind and ciliated, denticulated externally, with short spinules in the notches between the teeth.

The female specimens vary in length from 14 mm. to 25 mm. and in breadth from 6 mm. to 10 mm., being mostly slightly broader in proportion than the type specimen, which is 26.5 mm. long, 10 mm. broad. The large male in the Blake Collection is 28 mm. long, 12 mm. broad; the small female, 17.5 mm. by 7 mm. A male collected by the U. S. Fish Commission at Station 871 is 22 mm. long, 9.5 mm. broad.

The typical specimen of this species is destitute of color markings, which may however have faded out from exposure to the light. Nearly all the other specimens are rather distinctly marked, chiefly along the sides of the body, with dark brown, arranged as follows. The lateral margins of the first thoracic segment, and the epimera sometimes of the third, and usually of the fourth, fifth, and sixth segments, but not of the seventh, are dark or nearly black, and the color extends distinctly to the adjacent regions of the fourth segment, and may extend across the back along the hinder margin of this segment; the next two segments may be similarly, but less strongly marked. On the pleon the color appears as a curved or crescentic band, along the lateral margins of the second, third, and fourth segments, and across the back part of the fifth and fore part of the sixth segments. On the sixth segment the color when present is divided by the median line into two more or less distinct spots, or maculæ. The posterior part of the telson is lighter-colored than the body.

This species has also been obtained by the U. S. Fish Commission at the following stations: —

Station.	Fathoms.	N. Lat.	W. Long.	Specimens.
871	115	40° 2′ 54″	70° 23′ 40″	5
874	85	40° 0′	70° 57′	Cast skin.
875	126	39° 57′	70° 57′ 30″	1
897	157	37° 25′	74° 18′	2
1108	101	40° 2′	70° 37′ 30″	1
Oct. 4, 1882	Trawl-line			1

Rocinela sp.

A single specimen, probably of an undescribed species of this genus, was obtained at Station 344, Lat. 40° 1′ N., Long. 70° 58′ W., from 129 fathoms.

This specimen, although 27 mm. in length, is not yet adult, as shown by the rudimentary condition of the seventh pair of legs, and differs from the preceding especially in having the eyes more finely granulated. The material is too incomplete to attempt a full description.

Syscenus infelix Harger.

Plate III. Figs. 5, 5 a. Plate IV. Figs. 3 - 3 h.

Syscenus infelix Harger, Rep. U. S. Fish Com., Pt. IV. for 1878, p. 387. 1880.

Three specimens of this species were obtained at two localities; viz. a single female at Station 303, Lat. 41° 34′ 30″ N., Long. 65° 54′ 30″ W., from 306 fathoms, and two males at Station 309, Lat. 40° 11′ 40″ N., Long. 68° 22′ W., from 304 fathoms. Besides these specimens a considerable number have also been obtained by the U. S. Fish Commission, from various localities along the coast as far south as Delaware Bay, and from a depth as great as 372 fathoms, so that the species, originally described from a single specimen, has now become comparatively common in the collection, and I am enabled to make some corrections in the description already given, as well as to add further details and present figures of the species.

Many of the specimens since obtained are larger than the type, and such examples often have the body quite distinctly corrugated and rather coarsely pitted, especially upon the head and the anterior part of the thorax or pereion. In some of the larger males the ocular regions on each side of the head are swollen and distinctly pitted and corrugated. On the lateral margin of the head is a notch, into which may be received a short process on the anterior angle of the first segment, thus producing a very firm articulation when the head is drawn closely against the first segment. The flagellum of the antennula is usually composed of seven segments instead of six, but the number may be different on opposite sides of the same specimen. A bottom view of the head, enlarged eight diameters, is given on Plate IV. Fig. 3, showing the antennary organs, the right antenna being removed to show the antennula of that side.

The maxillipeds (Pl. IV. Fig. 3 c) are robust, thickened along the inner or median side where they meet; the first segment of the palpus is large, nearly square, and armed at its inner distal angle with a single hook; its distal margin is shorter than the proximal, and is angulated at the articulation with the second short transverse segment. This segment is armed distally with three hooks, of which the anterior appears to be articulated and should perhaps be regarded as a third segment of the palpus. The outer or second maxillæ are thin, delicate, and obscurely lobed at the tip, where they are armed with a single small hook. The inner or first maxillæ (Pl. IV. Figs. 3 b, 3 b′) are armed with spines, of which the inner are shorter and straight, the outer are larger and curved or hooked at the tip. The mandibles (Pl. IV. Fig. 3 a) are robust at base, but slender and acute at the tip.

In the prehensile, or first three pairs of legs, the merus, carpus, and propodus are each armed with a short, curved, blunt spine on the palmar margin, as shown in the figure of a leg of the first pair on Plate IV. Fig. 3 d. The remaining four pairs of legs, not all natatory, are well fitted for prehension by their slender curved claws, and differ considerably in their proportions in specimens of different sizes, as shown by the accompanying table of measurements. All the legs are strongly flexed at the articulation of the basis with the ischium. In the sixth and seventh pairs, the ischium, merus, carpus, and propodus are elongated and in the small specimens slender, so that, with the addition of the dactylus, the last five segments of the leg of the sixth pair may attain to five sixths or even seven eighths the length of the body. The bases do not participate in this elongation and are therefore omitted in the measurements, since to include them would only diminish the contrast between the large and small specimens, shown especially in the last six columns of the table. In large specimens, like the one figured, the sixth and seventh pairs of legs are much more robust than in smaller ones.

The pleopods (Pl. IV. Fig. 3 g) are not naked, as originally described, but all the anterior ones, as usual in the *Ægidæ*, are distinctly ciliated. The cilia are however short and not very evident, and were overlooked in the single specimen described. In the small specimens they are proportionally longer than in larger ones. The second pair of pleopods in the male (Pl. IV. Fig. 3 g) bears a slender stylet tapering to the tip, and about as long as the ramus to which it is attached. In the small specimen, whose measurements are given in the last column of the table, the stylet is blunt, and considerably shorter than the ramus. The uropods (Pl. IV. Fig. 3 h) are robust; the basal segment is oblique, but not much produced internally; the rami are well ciliated.

Professor Verrill states that in life this species is bright colored, varying from bright orange to salmon-colored above and light yellow underneath. This color soon fades in alcohol.

Considerable variations in size, and corresponding variations in the proportions, especially of the sixth and seventh pairs of legs, are shown in the following table of measurements, in which the first three columns contain measurements of the Blake Expedition specimens, the next four columns contain measurements of specimens obtained at a single locality (Station 945) off Martha's Vineyard, by the U. S. Fish Commission in the summer of 1881, while in the last column are measurements of a smaller specimen obtained by the Fish Commission at another locality (Station 1028) in the same region. The measurements in the fourth column are from the specimen figured on Plate III. Figs. 5 and 5 a; those of the next five columns are from specimens gradually decreasing in size to the last. The length of the ambulatory legs, especially those of the sixth and seventh pairs, is seen to increase proportionally as the length of the body diminishes, except in the case of the seventh pair of legs of the last specimen. This is doubtless to be explained as a mark of immaturity in addition to the one already noted in the second pair of pleopods. The measurements are in millimeters, and the proportion of each to the length of the body is indicated by the accompanying decimal.

MEASUREMENTS.*

Syscenus infelix H.	B. ♀ 303	B. ♂ 309	B. ♂ 309	F. C. ♂ 945	F. C. ♂ 945	F. C. ♂ 945	F. C. ♀ 945	F. C. ♀ 945	F. C. ♂ 1028
Length of body	1.00 24.5	1.00 31.0	1.00 30.0	1.00 44.0	1.00 32.0	1.00 27.0	1.00 25.0	1.00 18.0	1.00 15.0
Transverse diameter of head	.16 3.8	.16 5.0	.15 4.5	.14 6.0	.16 5.0	.15 4.0	.16 4.0	.18 3.2	.19 2.8
" " 1st segment	.33 8.0	.29 9.0	.31 9.2	.28 12.5	.28 9.0	.30 8.0	.32 8.0	.33 6.0	.33 5.0
" " 3d segment	.36 8.8	.35 11.0	.35 10.5	.34 15.0	.33 10.5	.33 9.0	.36 9.0	.41 7.4	.35 5.2
" " 7th segment . . .	.27 6.5	.26 8.0	.27 8.0	.26 11.5	.25 8.0	.23 6.2	.26 6.6	.25 4.5	.27 4.0
" " pleon at base . . .	.20 5.0	.18 5.5	.18 5.5	.19 8.0	.17 5.5	.17 4.5	.20 5.0	.20 3.6	.20 3.0
" " last segment of pleon	.23 5.6	.23 7.2	.26 7.8	.25 11.2	.24 7.5	.21 5.6	.23 5.8	.22 4.0	.21 3.2
Longitudinal diameter of last segment of pleon	.23 5.6	.26 8.0	.29 8.6	.27 12.0	.26 8.2	.21 5.6	.23 5.8	.25 4.5	27 4.0
Length, beyond basis, of leg of 3d pair . . .	.18 4.5	.16 5.0	.17 5.0	.14 6.0	.18 5.2	.15 4.0	.17 4.2	.17 3.0	.20 3.0
" " " " 4th pair . .	.30 7.0	.26 8.0	.27 8.0	.25 11.0	.25 8.0	.26 7.0	.28 7.0	.28 5.0	.33 5.0
" " " " 5th pair . .	.37 9.0	.35 11.0	.33 10.0	.30 13.0	.31 10.0	.33 9.0	.34 8.5	.42 7.5	.40 6.0
" " " " 6th pair . .	.66 16.0	.58 18.0	.53 16.0	.45 20.0	.50 16.0	.63 17.0	.68 17.0	.83 15.0	.87 13.0
" " " " 7th pair . .	.53 13.0	.50 15.5	.47 14.0	.41 18.0	.42 13.5	.54 14.6	.60 15.0	.67 12.0	.61 9.2

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* In the table of measurements B. is used to denote the Blake Expedition, F. C. the U. S. Fish Commission, and the accompanying numbers refer to the stations at which the specimens were obtained. The measurements are in millimeters, and over each is placed in small figures the corresponding decimal part of the length of the body.

New Haven, September 6, 1883.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Cirolana polita* Harger ex Stimpson. Lateral view of female, enlarged three diameters.
" 1 a. Antennula of another specimen, enlarged twelve diameters.
" 1 b. Antenna of same, enlarged twelve diameters.
" 1 c. Lateral view of pleon of *C. polita* as in fig. 4, enlarged five diameters.
" 2. *Cirolana spinipes* Bate & Westwood. Lateral view of female, enlarged three diameters.
" 2 a. Antennula of another specimen, enlarged ten diameters.
" 2 b. Antenna of same, enlarged ten diameters.
" 2 c. Pleon of *C. spinipes* as in fig. 4, enlarged five diameters.
" 2 d. Pleopod of the second pair of *C. spinipes*, male, enlarged eight diameters.
" 3. *Cirolana impressa* Harger. Lateral view of female, enlarged three diameters.
" 3 a. Antennula of another specimen, enlarged twelve diameters.
" 3 b. Antenna of same specimen, enlarged twelve diameters.
" 3 c. Pleon of *C. impressa* as in fig. 4, enlarged five diameters.
" 3 d. Pleopod of the second pair of *C. impressa*, male, enlarged eight diameters.
" 4. Pleon of *Cirolana concharum* Harger ex Stimpson, showing the first five segments in a lateral view, with dotted outline of last thoracic segment and its epimeron, enlarged five diameters.

PLATE II.

Fig. 1. *Cirolana spinipes* Bate & Westwood. Last segment of pleon with uropods, enlarged six diameters.
" 1 a. Leg of the first pair, enlarged eight diameters.
" 1 b. Leg of the fourth pair, enlarged six diameters.
" 1 c. Leg of the seventh pair, enlarged six diameters.
" 2. *Cirolana polita* Harger ex Stimpson. Last segment of pleon with uropods, enlarged six diameters.
" 2 a. Leg of the first pair, enlarged eight diameters.
" 2 b. Leg of the fourth pair, enlarged eight diameters.
" 3. *Cirolana impressa* Harger. Last segment of pleon with uropods, enlarged six diameters.

Fig. 3 a. Leg of the first pair, enlarged eight diameters.
" 3 b. Leg of the fourth pair, enlarged eight diameters.
" 3 c. Leg of the seventh pair, enlarged eight diameters.
" 4. *Cirolana concharum* Harger ex Stimpson. Last segment of pleon with uropods, enlarged six diameters.
" 4 a. Leg of the first pair, enlarged eight diameters.
" 4 b. Leg of the fourth pair, enlarged eight diameters.
" 4 c. Leg of the seventh pair, enlarged eight diameters.

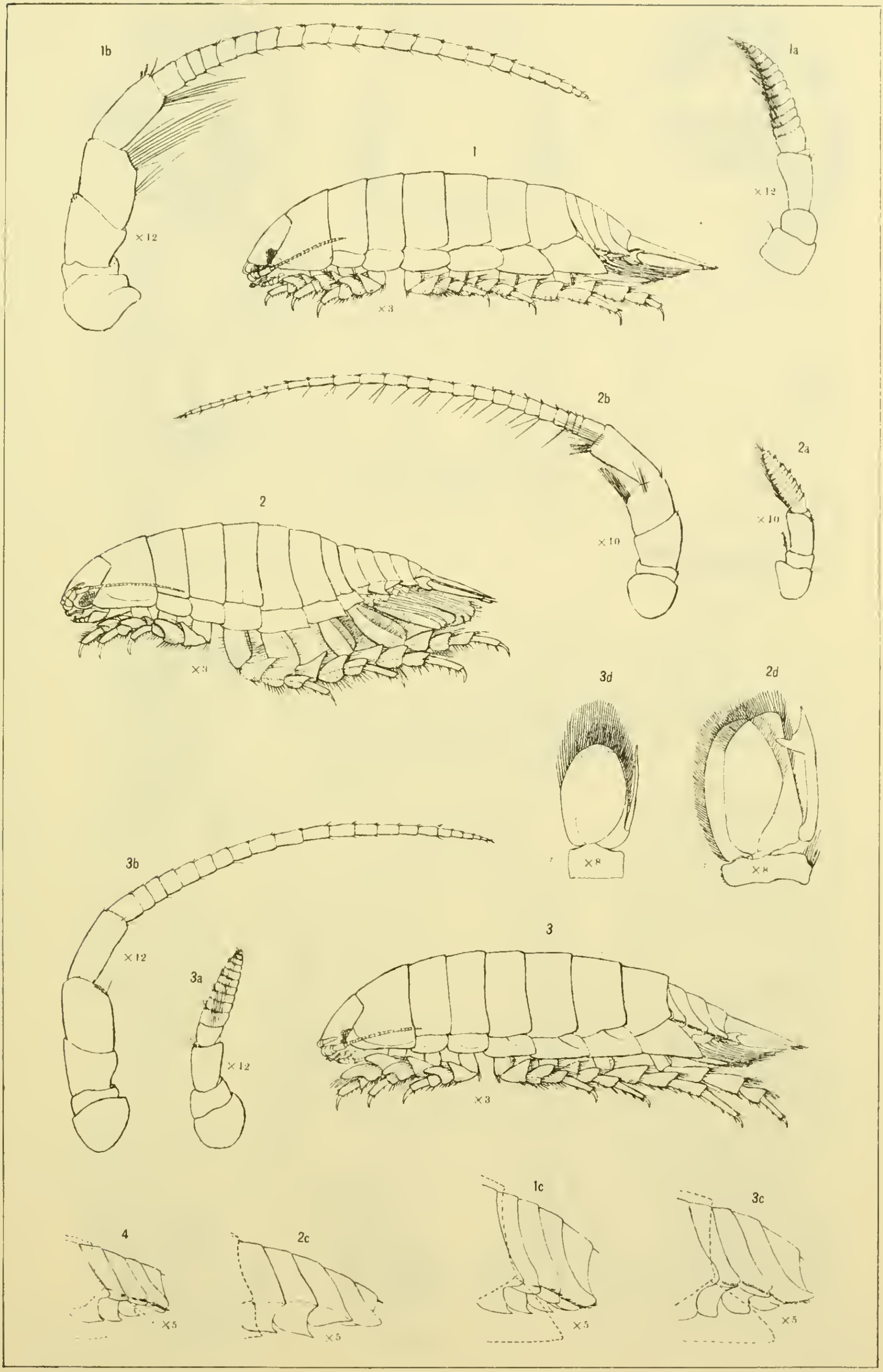
PLATE III.

Fig. 1. *Æga incisa* Schiödte & Meinert. Dorsal view of specimen from Station 307, enlarged five diameters.
" 2. *Rocinela oculata* Harger. Dorsal view of specimen from Station 305, enlarged six diameters.
" 2 a. Ventral view of same specimen, enlarged six diameters.
" 3. *Rocinela Americana* Schiödte & Meinert. Dorsal view of female, enlarged three diameters.
" 3 a. Ventral view of same specimen, enlarged three diameters.
" 4. *Rocinela Americana* Schiödte & Meinert. Head and first thoracic segment of male, enlarged three diameters.
" 5. *Syscenus infelix* Harger. Dorsal view of male, enlarged one and one half diameters.
" 5 a. Lateral view of same specimen, enlarged one and one half diameters.

PLATE IV.

Fig. 1. *Rocinela oculata* Harger. Leg of the first pair from specimen figured on Plate III., enlarged fifteen diameters.
" 2. *Rocinela Americana* Schiödte & Meinert. Leg of the first pair, enlarged ten diameters.
" 2 a. Leg of the sixth pair of the same, enlarged six diameters.
" 3. *Syscenus infelix* Harger. Inferior view of the head, right antenna removed to show the antennula, enlarged eight diameters.
" 3 a. Left mandible of same, enlarged twenty diameters.
" 3 b. Maxilla of the first or inner pair, enlarged twenty diameters.
" 3 b′. Tip of same, enlarged about seventy-five diameters.
" 3 c. Left maxilliped of same, enlarged twenty diameters.
" 3 d. Leg of the first pair of same, enlarged four diameters.
" 3 e. Leg of the fourth pair of same, enlarged four diameters.
" 3 f. Leg of the sixth pair of same, enlarged four diameters.
" 3 g. Pleopod of the second pair of same, male, enlarged four diameters.
" 3 h. Uropod of same, enlarged four diameters.

PLATE I.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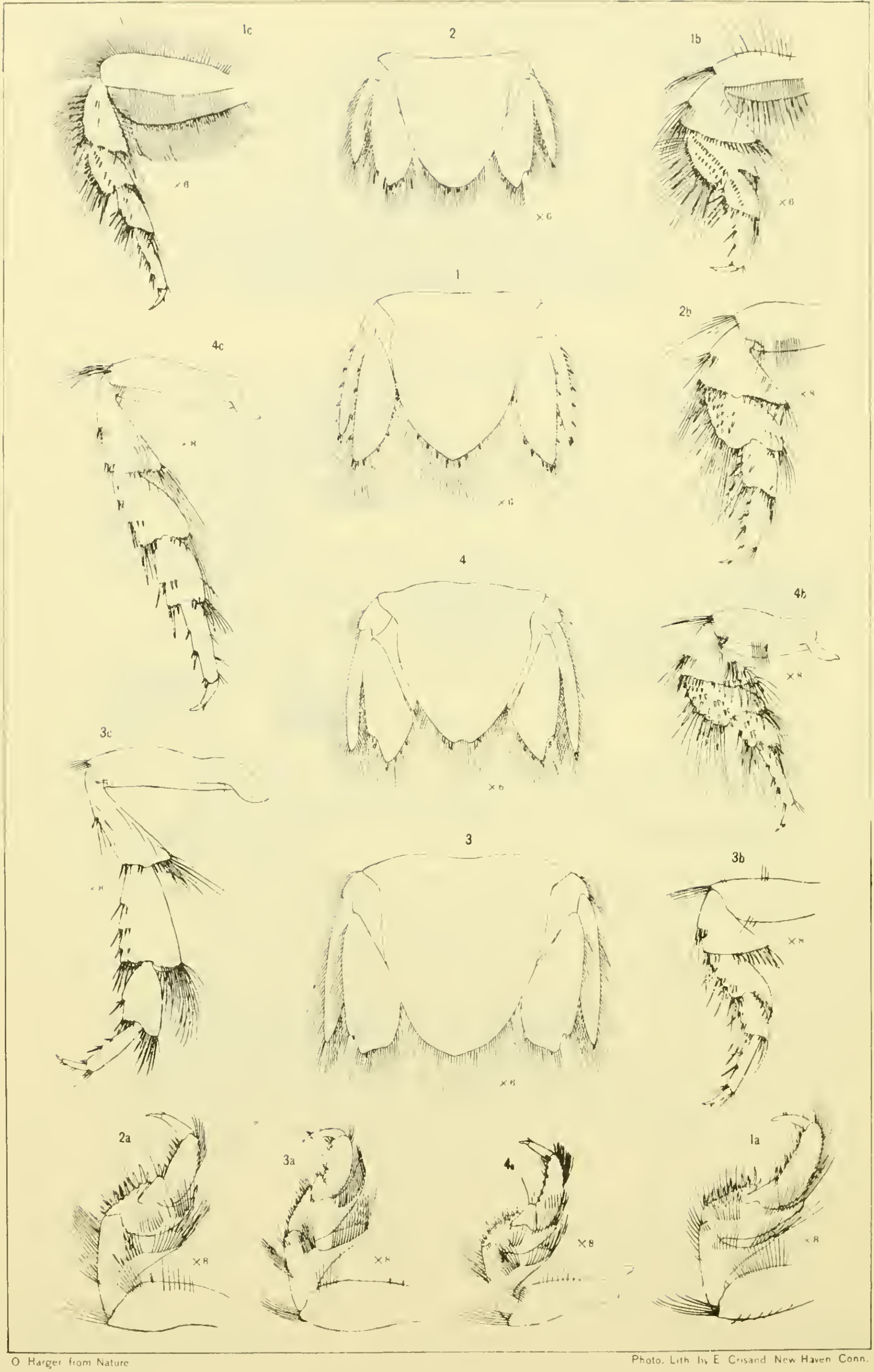
O Harger, from Nature

Photo Lith by E. Crisand, New Haven Conn.

CIROLANA POLITA. C. SPINIPES. C. IMPRESSA. C. CONCHARUM.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O. Harger from Nature

Photo. Lith. by E. Crisand New Haven Conn.

CIROLANA POLITA. C. SPINIPES C. IMPRESSA C. CONCHARUM.

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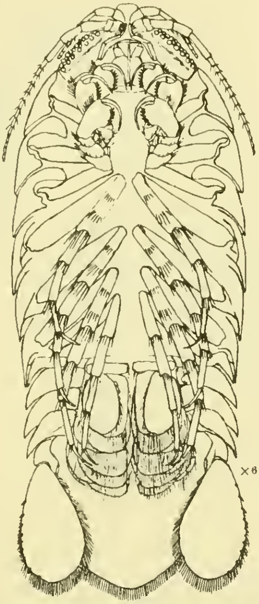

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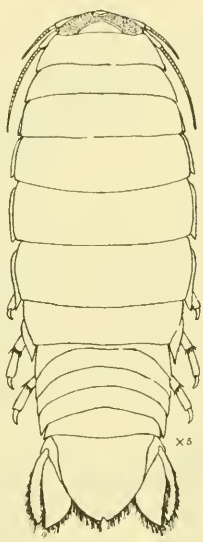

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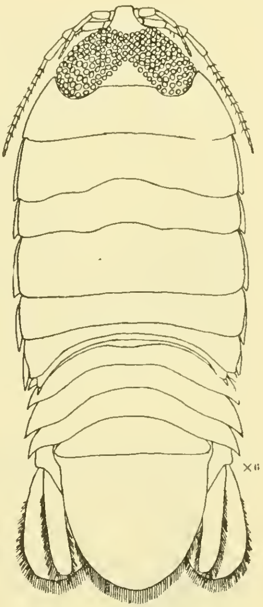

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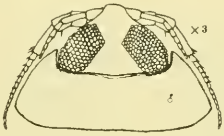

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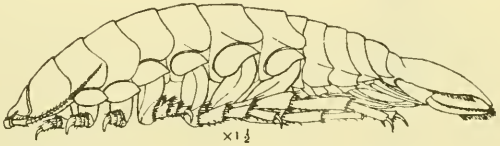

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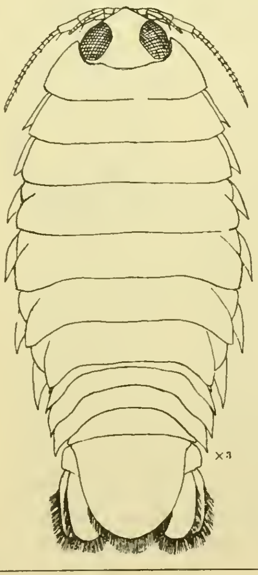

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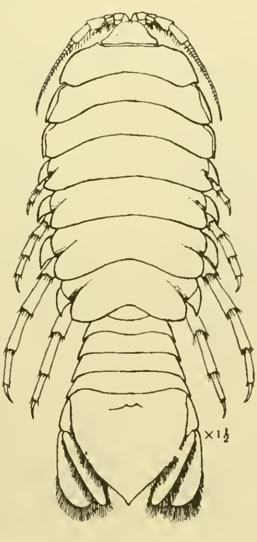

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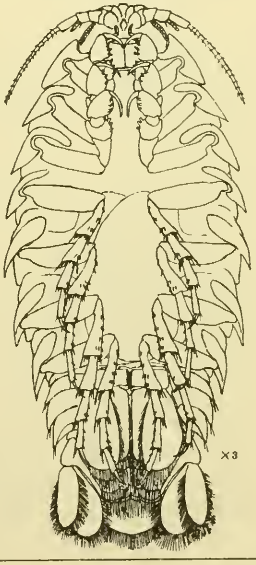
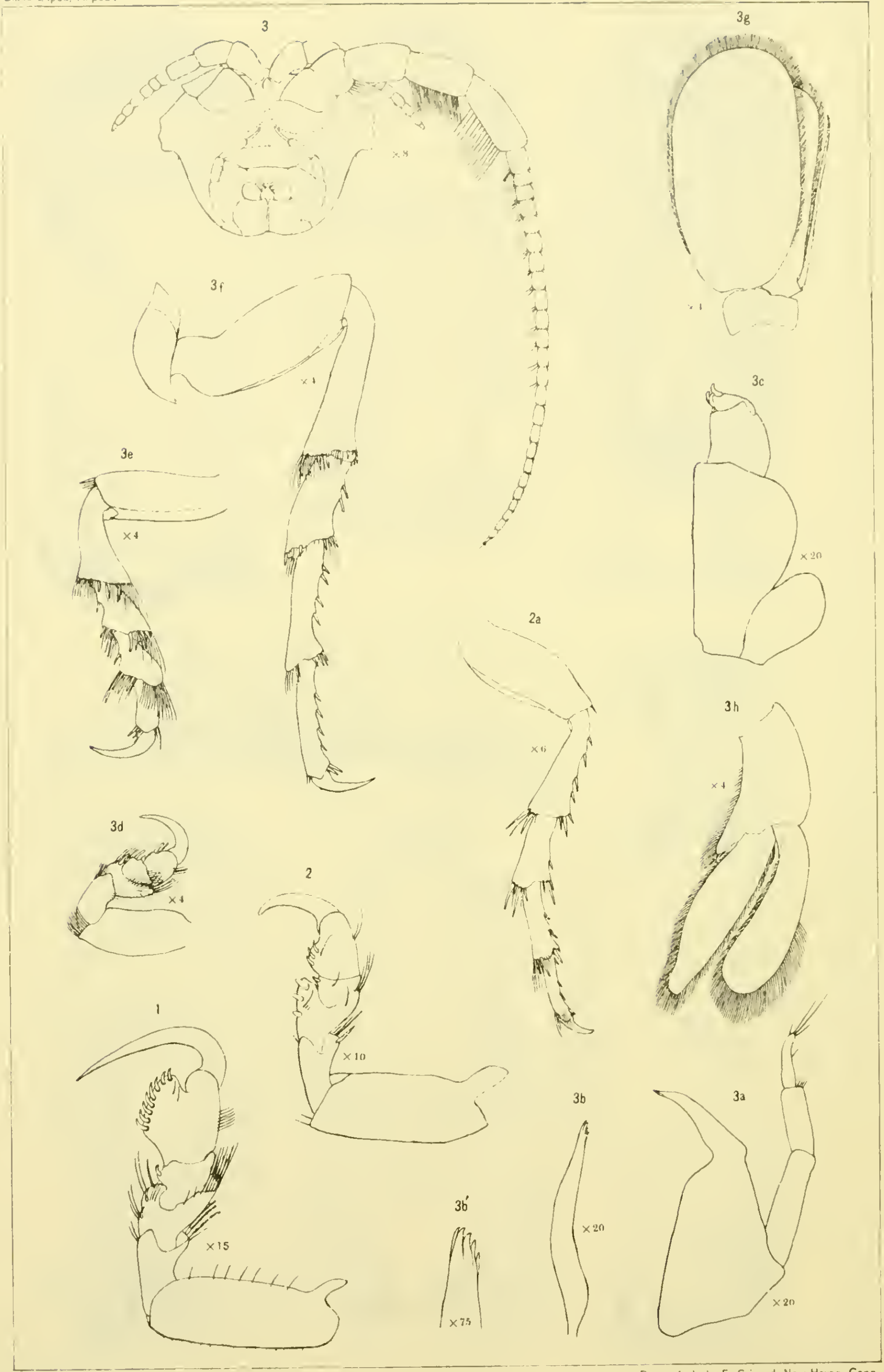


O. Harger, from Nature.
Photo. Lith. by E. Crisand, New Haven, Conn.

AEGA, ROCINELA, SYSCENUS.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×20

O. Harger, from Nature

Photo. Lith. by E. Crisand, New Haven, Conn.

ROCINELA. SYSCENUS.

No. 5. — *Reports on the Results of Dredging, under the Supervision of* Alexander Agassiz, *in the Gulf of Mexico and in the Caribbean Sea* (1878–79), *by the U. S. Coast Survey Steamer "Blake,"* Lieut.-Commander C. D. Sigsbee, U. S. N., *and* Commander J. R. Bartlett, U. S. N., Commanding.

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XXV.

Supplementary Report on the Blake Cephalopods. By A. E. Verrill.

The following paper includes the results of an examination of a small collection of Cephalopods received after my former report had been printed. The specimens are not numerous, but among them there are two very remarkable new genera, of unusual interest.

All the specimens in this lot were taken in the West Indian region, and mostly in rather deep water.

Abralia megalops Verrill.

Amer. Jour. Sci., Vol. XXIV. p. 364, 1882.

Plate III. Fig. 4.

A small immature specimen occurred at Station 294, in 137 fathoms, off Barbados, 1878–79.

The body is moderately long, pointed posteriorly, with the anterior mantle-edge prolonged into a broad, blunt median angle. Caudal fins large, the base rather large, occupying nearly one third the length of the mantle. Taken together the outline is broad-rhomboidal, and slightly sagittate; the outer angle of the fin is obtusely pointed; the anterior margin is broadly convexly curved, projecting forward somewhat beyond the base. Head rather large. Eyes very large. Arms slender, the dorsal ones shorter than the others, which are subequal. Tentacular arms long, very slender, more than twice as long as the sessile ones. The connective cartilage at the base of the siphon is large, broadest posteriorly, tapering to a blunt point anteriorly, with a central longitudinal furrow, having thickened margins.

The color is whitish, with rather large, well-separated, reddish brown chromatophores, both above and below ; a large dark brown spot on the head above each eye.

The basal portion of the arms is destitute of suckers for some distance, then there are two alternating rows of small hooks along the middle ; these are followed, distally, by two rows of small oblique suckers, having the horny rim of the orifice armed on the outer or higher side with several long, slender, incurved teeth.

The clubs are small, but distinctly enlarged and bordered by lateral membranes ; in the middle portion there is a row of three or four larger elongated hooks, with a few smaller ones in the same row, and a row of suckers alternating with the hooks ; outside of these, on each side, there is a row of marginal suckers ; at the tip there is a crowded cluster of minute suckers ; on the wrist there is a small group of smooth suckers and tubercles.

Length of the mantle, dorsally, 12 mm.; length of body and head, 14 mm.; breadth of head, 5.5 mm.; breadth across fins, 12 mm.; from tip of tail to anterior lobe of fin, 7 mm.; tip of tail to origin of fin, 6 mm.; length of tentacular arms, 15 mm.

The figure is from the type-specimen taken by the U. S. Fish Commission off Martha's Vineyard, Station 1137, in 173 fathoms.

Sthenoteuthis Bartramii (LES.) VERRILL (?).

VERRILL, Trans. Conn. Acad., Vol. V., p. 223, 1880, p. 288, 1881.
Ommastrephes Bartramii D'ORBIGNY, Ceph. Acetab., Pl. 2, figs. 11–20.
STEENSTRUP, Oversigt k. Danske Vid. Sels. Forhandl., 1880, p. 79, fig. 2, p. 81, fig. 3, p. 89.

A fragment of an arm, from a rather large species of *Ommastrephes* or *Sthenoteuthis*, was obtained by Commander J. R. Bartlett. It was brought up on the sounding lead in 607 fathoms, $4\frac{1}{4}$ miles N. W. $\frac{3}{8}$ W. of Sombrero Light, N. Lat. 18° 36′, W. Long. 63° 32′ 30″ ; temperature of the bottom, 41°.

This fragment is about 60 mm. long and 10 mm. broad at the larger end. It is from the terminal portion of an arm of which the tip had been amputated and healed. The suckers are rather large, on slender pedicles, which arise from swollen elevations on the inner surface of the arm ; each margin of the inner face is bordered by a moderately wide, thin, incurved membrane, which is supported by well-marked transverse muscular ridges, which run out from between the bases of the suckers. The suckers are obliquely attached, with very oblique apertures ; the basal half of the cup is much smaller than the outer portion, and is separated from it by a distinct constriction ; the distal portion is obliquely cup-shaped, with the inner side much narrower than the outer ; the margin is supported by a very broad, horny rim ; the outer edge of the aperture is surrounded by a circle of 12 to 14 regular, close, very sharp incurved teeth, of which the median one is not distinctly larger than those adjacent ; the inner half of the border is armed by numerous, very much smaller, sharp denticles; outside of the horny rim the marginal membrane is covered with a regular circle of minute horny plates.

The transverse breadth of this arm-fragment at the thickest end is 9 mm.; across internal face, with the lateral membranes extended, 15 mm.; length of transverse muscular bands of the marginal membranes, 4 mm.; diameter of the largest suckers, 4 mm.; height of cups, 5 mm. Number of larger teeth on the sucker-rings, 14 to 17; of smaller ones on the inner edge of the rim, 8 to 10.

Cheiroteuthis lacertosa Verrill.

Trans. Conn. Acad., V., p. 408, Pl. 56, figs. 1–1 f, 1881; Report U. S. Fish Commission for 1879, [pp. 110, 209,] Pl. 46, figs. 1–1 f, 1882.

A specimen of this rare species, somewhat smaller than the original type-specimen, was obtained. It has both tentacular arms with the clubs in good condition. It agrees closely with the type-specimen, already described in detail, and figured by me, in all its essential characters. In color it differs only in being somewhat paler, and in having rather distinct pale, or whitish, small round spots scattered over the dorsal surface. The row of dark spots along each of the ventral arms is very distinct.

Measurements of Cheiroteuthis lacertosa.

Length of body to dorsal edge of mantle.	77	mm.
Breadth of body,	14	“
Length of caudal fin,	40	“
Transverse breadth across fins, about	30	“
Length of head from dorsal cartilage to base of arms,	36	“
Breadth of head at eyes,	15	“
Length of dorsal arms,	60	“
“ “ “ 2d pair,	75	“
“ “ “ 3d pair,	96	“
“ “ “ 4th pair,	153	“
Diameter of dorsal arms at base,	4	“
“ “ “ “ 2d pair,	5	“
“ “ “ “ 3d pair,	5.5	“
“ “ “ “ 4th pair,	9	“
Length of tentacular arm,	660	“
Length of club,	60	“
Its breadth, in the middle	8	“
Diameter of largest suckers of lateral arms,	2	“
“ “ “ ventral arms,	1	“

Station 230, in 464 fathoms, off St. Vincent, W. I., 1878–79.

A very large specimen of this species has recently been taken by the U. S. Fish Commission steamer “Albatross,” at Station 2074, in 1309 fathoms, N. Lat. 41° 43′, W. Long. 65° 15′ 20″.

NECTOTEUTHIS Verrill, gen. nov.

Sepiolidæ allied to *Stoloteuthis.* Mantle with a free anterior dorsal edge; ventrally forming a sort of shield for the lower surface of the body, and prolonged far forward beyond the eyes, as a broad upturned lobe. Fins large, thin. Eyes large. Arms united by a web of considerable extent. Sessile arms, in the type-specimen (probably male) with the suckers on the distal part very minute, conical, sessile on the ends of stout tapering or conical pedicels; those on the proximal part normal, small, oblique, with slender pedicels. Pen not observed, perhaps wanting. Club of tentacular arms with numerous minute, subequal suckers, in many rows.

Nectoteuthis Pourtalesii Verrill.

Plate III. Figs. 1-1b.

A very small species, remarkable for its short, thick body; the great size of the ventral shield, which extends forward beyond the bases of the ventral arms; and the large conical sucker-pedicels, surmounted by minute suckers, on the distal half of the arms.

Body short, higher than broad, and well rounded behind; dorsal surface convex; the free mantle border is nearly transversely truncated, with a slight lobe in the middle; sides, below the fins, compressed, nearly vertical. A large ovate, convex shield occupies nearly the whole ventral surface, extending backward nearly to the posterior end, covering the whole width in the middle, and extending forward far beyond the lateral and dorsal mantle-margins, and to the anterior portion of the head; the anterior margin of the ventral shield is curved upward, leaving a deep concavity within; this portion of the ventral shield conceals and protects the entire lower surface of the head and siphon; on the sides, the margin recedes in such a way as to leave the large, prominent eyes exposed. The fins are attached above the middle line of the body; moderately large, very thin and delicate, transparent, except at base, with the margin undulated in the preserved specimen; the bases of the fins extend forward close to the margin of the mantle and backward about half the length of the body; the anterior end is evenly rounded, forming nearly a semicircle. Head large, as broad as the body, narrowed in front. The eyes, which are very large and prominent, occupy nearly the whole of the sides of the head; eyelids thin but distinct; pupil round. Arms small, slender, unequal in size and length, and connected together for some distance by a basal web, which extends farthest between the dorsal arms and is wanting between the ventral pair. The web has an outer fold, as it passes the second pair of arms, so that the latter appear to be inside the edge of the web. Dorsal arms much shorter than the lateral and ventral pairs, the free tips projecting but little beyond the edge of the web. The arms increase successively in length from the dorsal to the ventral pairs, which scarcely exceed the third pair, but all have the same kinds of suckers, in two alternating rows; the free portion is slender, rounded externally, and tapers to a slender tip; on the distal half, the sucker-pedicels are long, very prominent, conical, larger than the suckers, and tapering toward the tip, which terminates in a minute conical sucker, without any constriction between it and the pedicel; of these there are ten or more pairs on the lateral and ventral arms, and four or five pairs on the dorsal arms; the length of the sucker-pedicels and suckers together is greater than the diameter of the arms; on the basal half of the arms the suckers are of the ordinary structure, as in *Rossia;* they are small, with small apertures, oblong, obliquely attached, on short, slender pedicels, which are surrounded by submarginal swellings of the arm-surface. Of these normal suckers there are nine to ten pairs on the lateral and ventral arms; of these two or three, at about the sixth or seventh pair, on the lateral arms, are distinctly larger than those before or beyond them. One or two of intermediate form connect the normal with the specialized suckers. The dorsal arms are united together along their inner surfaces, which turn toward each other, for some distance from the base by a thickened membranous fold, which forms a sort of pocket or sinus between the arms, probably for sexual purposes. Tentacular arms are long, slender, triquetral, tapering distally; club small, curled, a little wider than the portion of the arm just below it, covered with numerous very minute suckers, arranged in many rows.

Siphon relatively large and prominent, projecting forward in front of the bases of the ventral arms.

Measurements of Nectoteuthis Pourtalesii.

Length to tip of longest sessile arm,	24	mm.
“ dorsal edge of mantle,	11	“
“ ventral edge of mantle,	17	“
“ bases of lateral arms,	17	“
Breadth of body (or head),	10	“
Diameter of eyeball,	6	“
Longitudinal extent of fin,	10	“
Breadth from base to outer edge,	6	“
Length of its insertion,	7	“
“ dorsal arms,	6	“
“ second pair,	7.5	“
“ third pair,	8.5	“
“ ventral arms,	10	“
“ tentacular arms,	30	“
“ club,	3	“

Color of the dorsal and lateral surfaces of alcoholic specimen dark reddish brown, due to a large number of chromatophores, which extend but a short distance beyond the bases of the fins; sides of the head, above the eyes, darker brown; ventral shield dark purplish brown, caused by great numbers of very minute chromatophores; its margin is surrounded by a pale band; arms and sucker-pedicels yellowish white, with a few small brown chromatophores; the outer portion of the fins is yellowish white and probably transparent when living.

The sex of the single example was not determined. Possibly the remarkable suckers and pedicels on the distal half of the arms may be due to hectocotylization, peculiar to the male. In this example the dorsal arms are closely united together, to near the tips, and within the web the basal portion is much thickened and the suckers are crowded and partially concealed by the incurved margins of the arms, and by their facing strongly toward each other. This may also be a sexual character.

Station 295, in 180 fathoms, off Barbados, Blake Expedition, 1878–79.

This curious species has a striking general resemblance to *Stoloteuthis leucoptera* V., from deep water off the New England coast. It is readily distinguished by the free dorsal edge of the mantle, by the ventral shield projecting much farther forward, and by the remarkable form and structure of the distal sucker-pedicels and suckers. The fins are smaller, and the arms more slender It is probable that the unique specimen is a male, and that some of the peculiar features of the arms and suckers may be only sexual.

Rossia brachyura Verrill, sp. nov.

Plate III. Fig. 2.

A small species with a very short body, large fins, and very small suckers, in two rows on the basal part of the arms, but in four rows distally.

Body unusually short, scarcely longer than broad, broadly rounded and somewhat emarginate posteriorly; mantle-edge advancing in a broad obtuse lobe dorsally, extending farther forward with a slight median emargination ventrally. Fins very large and prominent, the insertion equal to about three quarters the length of the body, the outer margin thin and broadly rounded, the anterior lobe free, rounded, and projecting forward beyond the mantle-edge, the posterior margin also free and projecting back somewhat as a rounded lobe, reaching nearly to the end of the body. Eyes large, with the lower lid slightly thickened. Sessile arms rather long, subequal in length, the dorsal ones a little shorter than the others. The suckers are similar in size and arrangement on all the sessile arms; on the basal third they are arranged in two rows; farther out they form four rows, which become crowded toward the tips. The suckers are very small, oblique, deep urceolate, with small apertures; they decrease regularly from near the middle to the tips of the arms. Tentacular arms moderately long and stout; club rather large, distinctly thickened, with a high dorsal keel; suckers very numerous and small, campanulate, crowded in about 16 rows, decreasing gradually in size from the upper to the lower edge, where they become very minute.

Color, in alcohol, pale purplish brown, with numerous small, unequal chromatophores, beneath as well as above; arms paler; fins whitish.

Length of body, above, 18 mm.; of body and head, 27 mm.; breadth of body, 15 mm.; length of insertion of fin, 12 mm.; its greatest length, front to back edge, 16 mm.; height, base to tip, 9 mm.; length of dorsal arms, 15 mm.; 2d pair, 17 mm.; 3d pair, 18 mm.: 4th pair, 17 mm.; of tentacular arms, 28 mm.; of club, 12 mm.; diameter of largest suckers of lateral arms, 60 mm.; of largest suckers of tentacular clubs, 12 mm.

Station 148, in 208 fathoms, off St. Kitts, 1878–79. One female.

Heteroteuthis tenera Verrill.

Amer. Jour. Sci., XX., p. 392, 1880; Bulletin Mus. Comp. Zoöl., XIII., p. 103, Pl. 3, figs. 5–5 b; Pl. 7, figs. 2–2 d, 3–3 b, 1881; Trans. Conn. Acad., V., p. 357, Pl. 46, figs. 2–2 d, 3–3 b, Pl. 47, figs. 5–5 b, 1881; Report U. S. Fish Com. for 1879, [p. 175,] Pl. 33, Pl. 34, fig. 1, 1882.

One specimen (♀), from Station 148, in 208 fathoms, off St. Kitts.

Octopus tuberculatus Blainv.?

A species with long arms, a short basal web, and peculiar branched cirri above the eyes and scattered over the back. Probably young.

The body is moderately large, oblong, swollen below, well rounded behind. Head about as broad as the body, with large prominent eyes. Upper surface of the body and head thickly covered with rather small, low warts, which also extend along the dorsal sides of the arms and on the basal web; scattered over the upper surface of the body and head are prominent cirri, some of which are simple and tapered, while others are divided into three to five digitate lobes or branches; of these, two are situated in the median dorsal line, four form a quadrangle on the dorsal surface of the body, and two are situated on each side of the body in line with the eyes; on the head, one is situated in the median dorsal line between the bases of the dorsal arms; one much larger and more complicated than the others is situated above each eye; this may have seven or eight slender branches; the eyelids are covered with prominent warts; the lower surface of the body is paler and smoother, with only minute inconspicuous warts, more evident anteriorly. Siphon moderately large, strongly tapered. The arms are long and rather slender, tapering to slender tips; they are subequal in size and length, the ventral ones a little smaller and shorter; the suckers are rather small, the two rows well apart; the two basal ones are much smaller than the succeeding ones and stand nearly in the median line. The basal web extends about one third the length of the arms; the arms are bordered for some distance by a thin, narrow, marginal membrane on each side. The hectocotylized arm is but little shorter than its mate, and tapers to an acute but modified tip; along the border of the arm there is an incurved marginal groove formed by the narrow, inflexed marginal membrane, which terminates in a minute conical papilla at the base of the modified tip ; this is very small, narrow, tapered, acute, with thickened margins and a narrow median groove, which is crossed by numerous, very small, transverse furrows. Color of the upper surface of the body, head, and basal web pale purplish brown, mottled and streaked with darker ; the color is due to numerous minute purplish chromatophores, among which there are a few larger, more definite, dark brown ones ; the warts appear to have been paler ; the cirri are yellowish white without chromatophores. The lower side of the body, head, siphon, and arms, with the inner surface of the arms, is yellowish white, having very few chromatophores, among which are a few very definite, small, dark brown ones.

Length of body, 17 mm.; of body and head, 22 mm.; breadth of body, 13 mm.; of head, 13 mm.; breadth of web, from mouth, 13 mm.; length of second pair of arms, 52 mm.; of first pair, 50 mm.; of third pair, 51 mm.; of the ventral arms, 50 mm.; of the hectocotylized arm, 45 mm.; length of the modified tip, 2.5 mm.; its breadth, 1 mm.

Stations 278, in 69 fathoms, and 296, in 84 fathoms, off Barbados, 1878–79. Three specimens.

Octopus pictus VERRILL, sp. nov.

Plate III. Fig. 3.

Body relatively large, oblong, smooth, bluntly rounded posteriorly. There is no constriction between the head and body, and the head is rather broader than the body; eyes large, rather prominent. There is a single small rounded wart over each eye. Web between the arms rather small, thin, extending about one fourth the length of the arms, narrower between the ventral arms. Arms moderately long, nearly equal in size and length. Suckers relatively large, in two rows, not crowded ; the two basal suckers are small, nearly in the middle line, the innermost ones forming a regular circle around the mouth. The color is peculiar; over the entire surface of the body, above and below, and on the upper surfaces of head, arms, and web, there are numerous rather large distinct, round, reddish brown or dark brown spots, usually with a darker central point ; between these there are numerous minute, lighter colored chromatophores ; inner surfaces of the web and arms yellowish white.

Length of the head and body, 8 mm.; breadth of body, 6 mm.; length of the arms, 16 mm.

Station 142, in 27 fathoms, Flannegan Passage, and Station 278, in 69 fathoms, off Barbados, 1878–79. One young specimen from each place.

Although the specimens are probably the young of some larger species, it is unlike any of the described West Indian forms known to me in its peculiar ocellated coloration and the very smooth surface of its body, with only a single wart above the eye.

OPISTHOTEUTHIS Verrill, gen. nov.

Body broad, depressed, closely united to the brachial web except at the posterior end, which projects slightly. Fins long, attached at about the middle of the body, near the dorsal surface; bases wide apart, each supported by a distinct transverse cartilage. Siphon small, projecting slightly from beneath the posterior end of the body, and directed backward, with a very small aperture. Head as broad as the body; eyes large. The lower surface of the head and body wholly attached to the brachial membranes. Arms subequal, united together to near their tips by a very broad, thick, soft web, which leaves only the inner surface of the arms exposed; suckers in a single row, those toward the base of the arms largest. On each side and alternating with the suckers is a row of small, tapered cirri; these commence in a rudimentary form between the first two suckers, and continue from there to the tips.

Opisthoteuthis Agassizii Verrill, sp. nov.

Plate I. Fig. 1. Plate II. Fig. 1.

The body is broad, depressed, rounded posteriorly, and with the head is wholly adnate to the web connecting the arms, except at the posterior end behind the fins, where it is slightly free and overhangs a little; the siphon projects backward beneath the posterior end in the groove thus formed; the branchial opening appears to have been small, partially surrounding the siphon, but the membranes in this region are much mutilated, so that its form and extent cannot be determined. The fins are large, thin, wide apart, elongated, oblong ovate in form, the outer end bluntly rounded, each fin is supported by a separate internal cartilage, of which the inner end is broadest and thick, while the outer end extending into the free portion of the fin is much thinner, lanceolate, tapering to a blunt point; this cartilage is situated much nearer to the posterior than to the anterior edge of the fin and does not extend much beyond its middle, leaving the terminal third thin and flexible. The head is about as large and as broad as the body; the eyes are very large and occupy the entire sides of the head. As seen from above the arms are concealed except at the tip by a thick, soft web, which unites them together and unites them closely to the sides of the head and body. The integument of the entire upper surface is very soft and flabby, and appears to have been smooth, although it is much wrinkled in the alcoholic specimen; the web between the arms extends to near the end, leaving only about one fifth free, and this portion is bordered by a membranous fold along each side. The web consists of an outer and inner portion, separated by considerable thickness; the inner membrane arises from the inner surface of the arms, which projects but little above it. The arms are rather large and moderately stout along the middle portion, much narrowed toward the bases, which are not in contact; the free ends are rather slender, compressed, with the tips attenuated; the first five suckers are much smaller than those that follow; the next five or six suckers are the largest; they decrease to about the tenth, and then become larger opposite the edge of the web, finally diminishing gradually to the tips; the cirri, which alternate with the suckers on each side, are widely separated from them along the middle of the arms; they are small, slender, tapered, acute, dark purplish brown in color; those toward the tip and close to the base of the arms are very small. The beak is moderately large, black. The buccal membrane is covered with small verrucæ.

Color of the upper surface chocolate-brown, with small scattered roundish spots of yellowish white. Fins paler brown. Inner surface of the web dark chocolate-brown. Inner surface of the arms much paler than the web.

Length of body and head, to base of arms, 60 mm.; breadth of body, 50 mm.; breadth of head across eyes, 52 mm.; extreme breadth across fins, 105 mm.; from base of fin to tip, 30 mm.; anterior to posterior edge, 17 mm.; diameter of eyes, 25 mm.; breadth of interbrachial web, from mouth, 75 mm.; length of dorsal arms, 130 mm.; of lateral arms, 120 mm.; of ventral arms, 130 mm.; greatest breadth of dorsal arms, 9 mm.: diameter of largest suckers, 3 mm.; length of cirri, 2 to 3 mm.

Station 260, in 291 fathoms, off Grenada, Blake Expedition, 1878–79.

This remarkable species differs widely from any hitherto described. It is more closely related to *Stauroteuthis sertensis* than to any other known species; from the latter and from *Cirrhoteuthis* it differs in having the body and head closely adnate to the brachial membranes so as to entirely conceal the ventral portions; in the posterior position of the siphon; and in the arrangement of the cirri on the inner surface of the arms. The fins appear to be larger and more highly developed than in either of the genera referred to. The transverse supporting cartilages are not united across the back, as they appear to be in both the related genera. The arrangement of the web between the arms appears to be unlike that of *Stauroteuthis*, but the only known specimen of the latter was in such a poor state of preservation as to render this statement unreliable. Perhaps the most remarkable characteristic of this species is the posterior position of the siphon and branchial opening, a position which is rendered necessary by reason of the close attachment of the head and body to the brachial membrane. The condition of the internal parts of the specimen is such as to render it impossible to determine the precise character and position of the branchial opening and gills. Only one specimen was obtained, and this is probably a female, for no evidence of hectocotylization can be detected on any of the arms, all of which are well preserved.

New Haven, October, 1883.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Opisthoteuthis Agassizii* Verrill. Dorsal view. Natural size.

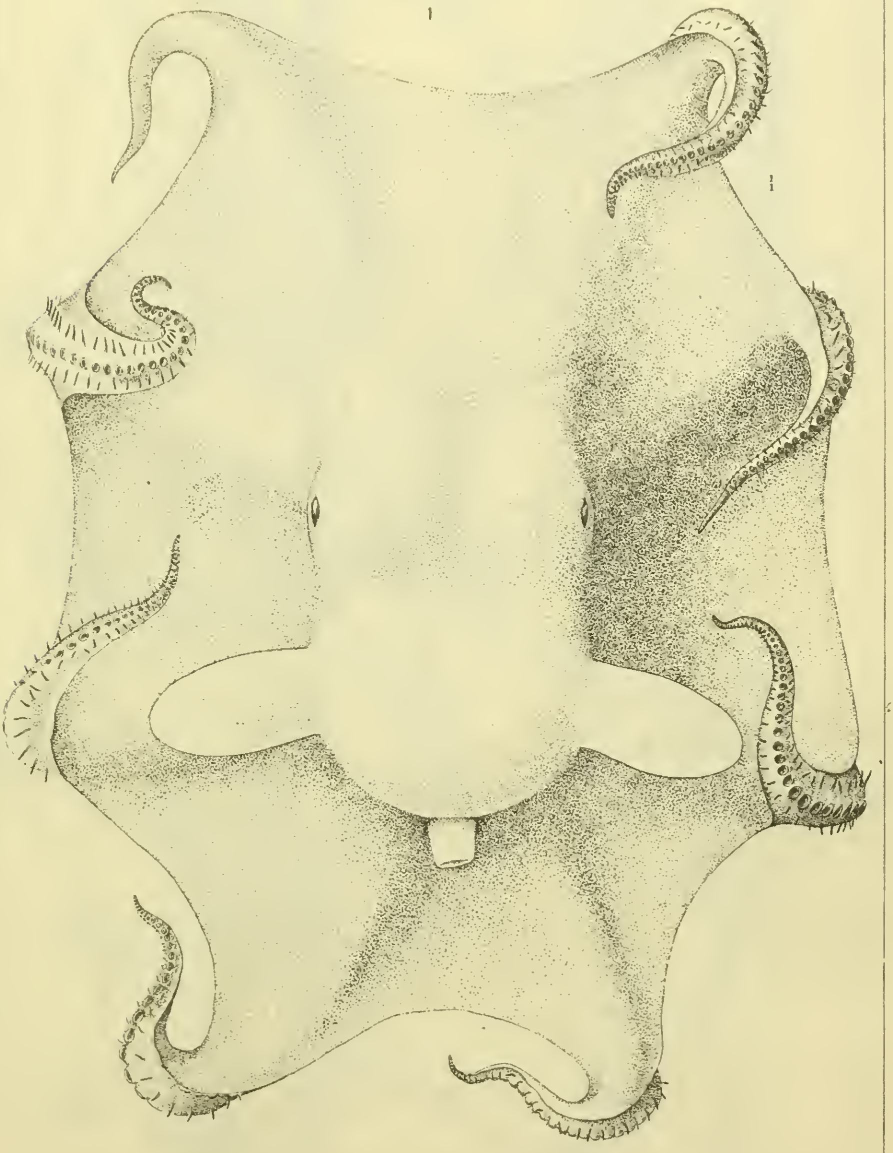
PLATE II.

Fig. 1. *Opisthoteuthis Agassizii* Verrill. Ventral view, showing the arrangement of the suckers and cirri. Natural size.

PLATE III.

Fig. 1. *Nectoteuthis Pourtalesii* Verrill. Dorsal view. Enlarged two diameters.
" 1 a. The same. Enlarged two diameters.
" 1 b. The same. Left arm of the fourth pair. Side view. Enlarged four diameters.
" 2. *Rossia brachyura* Verrill. Left arm of the second pair. Front view. Enlarged four diameters.
" 3. *Octopus pictus* Verrill. Dorsal view. Enlarged three diameters.
" 4. *Abralia megaptera* Verrill. Ventral view of the type-specimen from Station 1137, in 173 fathoms. Enlarged two diameters.

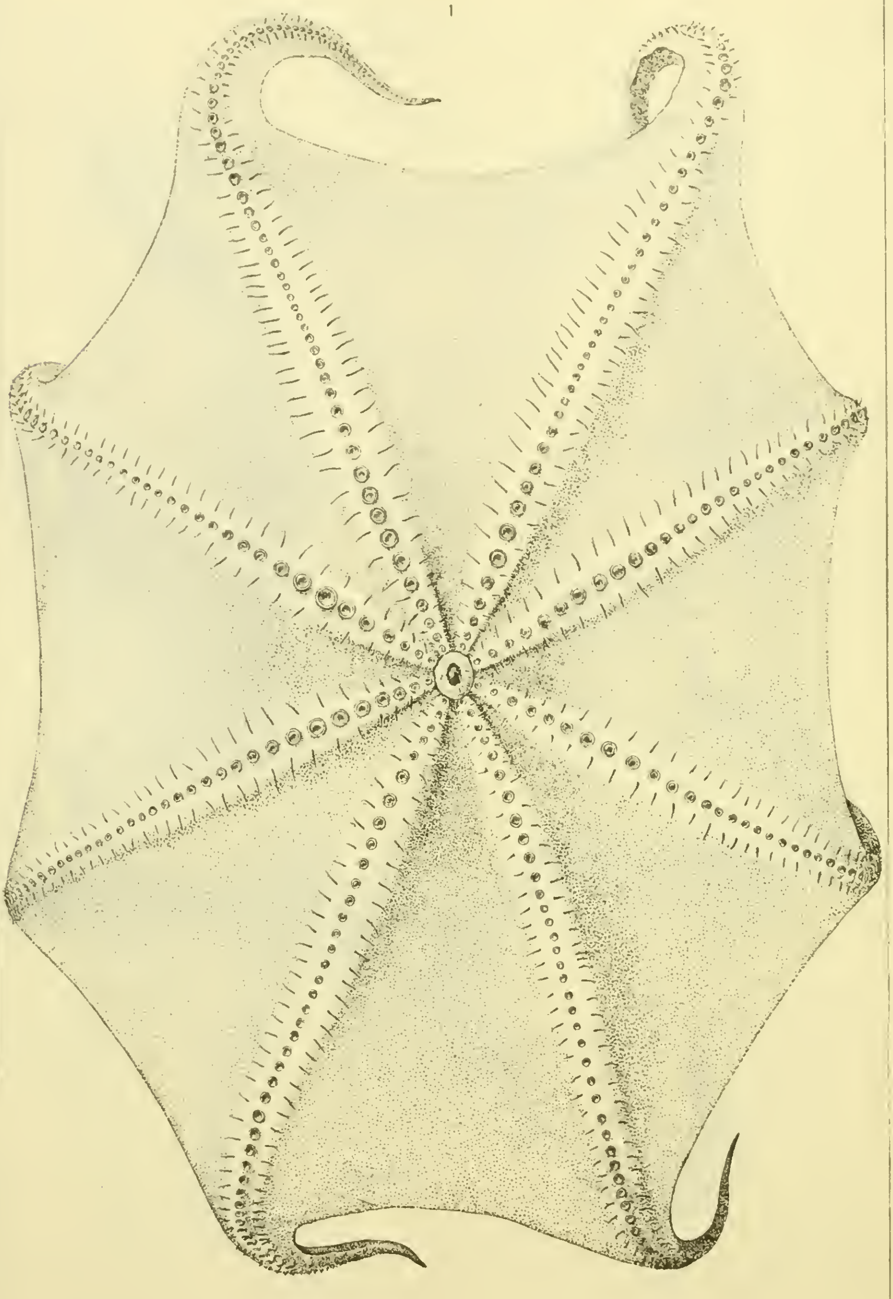
1



J H Emerton, from Nature

Photo Lith by L S Punderson, New Haven, Conn

OPISTHOTEUTHIS AGASSIZII VERRILL.

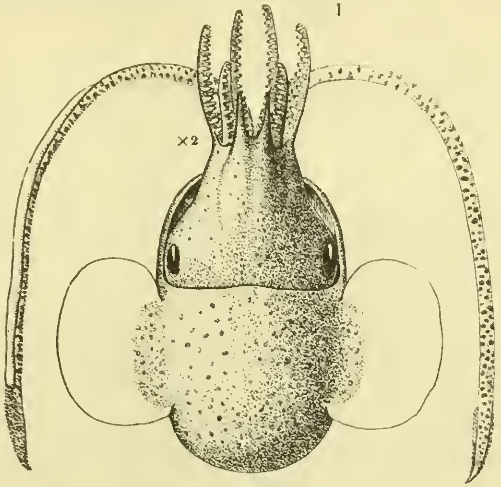


J. H. Emerton, from Nature

Photo Lith by L. S. Punderson, New Haven, Conn.

OPISTHOTEUTHIS AGASSIZII VERRILL.

1



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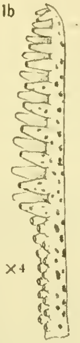

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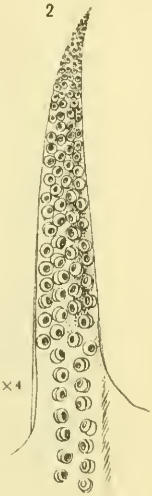

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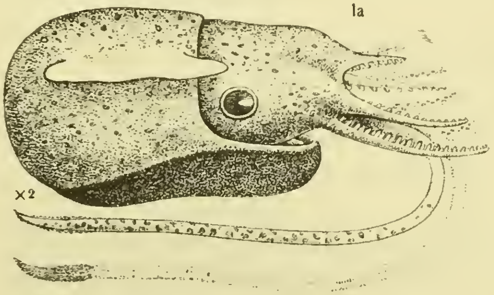

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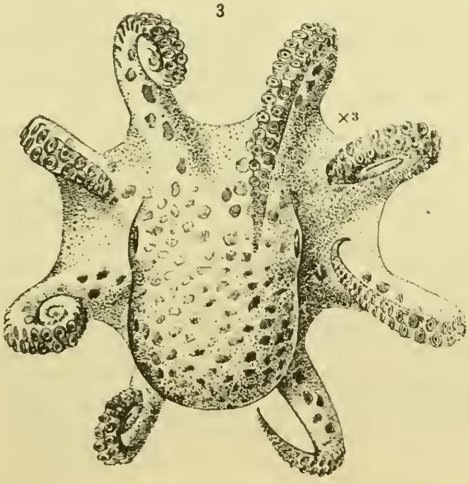

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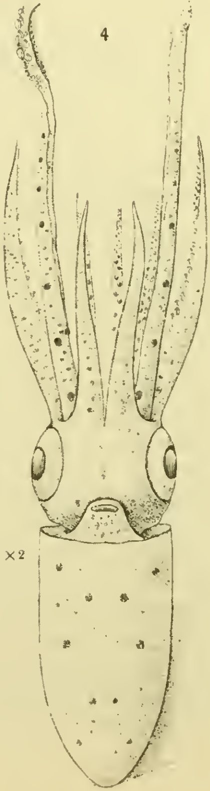


J H Emerton, from Nature
Photo Lith by L S Punderson, New Haven, Conn

No. 6. — *Descriptions of Two Species of Octopus from California.*
By A. E. Verrill.

In the following paper the large *Octopus punctatus*, which inhabits the Pacific coast, from San Francisco to Sitka, is described and figured more fully than hitherto. A new species, known to the author for many years, is described under the name of *O. bimaculatus*, a name intended to recall the presence of two large dark spots, one in front of each eye, near the bases of the arms. This species ranges from San Diego to Panama, and perhaps even farther south.

Octopus punctatus Gabb.

Octopus punctatus Gabb, Proc. California Acad., II., p. 170, 1862.
Dall, Proc. California Acad., III., p. 243, fig. 27 (dentition), 1866.

Plate IV. Plate V. Fig. 2.

Body in preserved specimens more or less ovate, or depressed pyriform, broadly rounded behind and narrowed toward the neck; upper surface of the body and head covered with a soft lubricous integument, which, in the best preserved examples, is strongly and irregularly longitudinally wrinkled, but these wrinkles can be easily smoothed out by the fingers, leaving only slightly thickened, irregular patches and blotches, which are of a darker brown color than the rest of the surface ; similar, slightly raised, darker spots, of smaller size, are numerous on the web and outer surface of the arms ; at the posterior end of the body the wrinkles are more conspicuous, and often give rise to prominent irregular folds, concentric to the body ; these appear to have more persistency than those of the dorsal surface, but as they can be nearly smoothed out, they probably appear and disappear during life, according to the state of contraction of the skin, as modified by the temper of the animal. The entire lower surface is smoother and paler, but shows small, irregular, scattered brown blotches, largest at the sides. The head is of moderate size, with prominent eyes ; above each eye are two large, prominent, compressed or angular, soft cirri, blunt at the tip, but not lobed ; the most anterior of these is opposite or in advance of the centre of the eye, the other is farther back ; around the bases of these cirri, and between them and the eyelids, there are numerous small, unequal, irregular, rounded and compressed warts, which stand somewhat in lines radial to the eye. The siphon is large and long, gradually tapered. The arms are, in normal specimens, subequal in size, very long, not very stout at base, and very slender toward the tip; the two lateral pairs are nearly equal, and a little longer than the dorsal ones; the ventral arms are slightly smaller at base than the others, and about equal in length to the dorsals, or sometimes slightly shorter. The web between the arms is broad and thin; it is widest between the lateral arms, where it is nearly one fourth as wide as the arms are long, and narrowest between the ventral ones; between the dorsal arms it is nearly as wide as between the laterals. The web extends as a lateral membrane along the sides of all the arms, but it is widest and extends farthest along the posterior margin of the dorsal and lateral arms and along the anterior margin of the ventrals. Along these margins the membrane can be traced nearly to the ends of the arms. On the anterior sides of the dorsal arms, and on the posterior margins of the ventral ones, the web rapidly narrows, and does not run very far out as a distinct fold, recognizable in preserved specimens. The sucker-bearing face of the arms is not very broad, the breadth of the arms being usually less than the depth, toward the base. The arms are stoutest about opposite the edge of the web, the portion nearer the mouth gradually narrowing. The suckers nearest the mouth are small and elevated, not very close together, alternating, but not standing far out of the median line; they gradually increase in size, to about the sixteenth or eighteenth, which are within the border of the web, where they attain their full size; the largest-sized suckers, in the male, continue for some distance beyond the edge of the intermediate web without much change in size; they are of nearly equal size on the three upper pairs of arms, but somewhat smaller on the ventral ones. Farther out the suckers very gradually diminish in size, becoming very small and very numerous toward the tips. The larger suckers are broad and moderately elevated, with a wide rim and a deep, crenulated central pit, from which strongly marked grooves radiate to the rim. The largest suckers have from 30 to 35 primary grooves that reach the margin of the central pit; many of these fork once, or even twice, toward the outer margin. The beak is strong and black.

The two large males examined have the third right arm hectocotylized, but not very conspicuously so. A well-marked membranous fold, of moderate breadth, runs from the web along the posterior edge of the arm nearly to the tip; its inner surface is white and smooth, and naturally curls inward, thus forming a groove, which, at a small, acute, conical papilla, situated at the base of the terminal organ, passes into the furrow of the latter. This organ is relatively small, narrow, rather long, tapering to the tip; its inner surface is flattened or concave, forming a groove where the margins are incurved. In the best preserved specimens the groove is covered internally, especially near its base, with small, soft, granule-like warts, or papillæ, in about six longitudinal rows, but there are no distinct transverse partitions. The hectocotylized arm, in one of the specimens, had 107 suckers, the distal ones being very small.

The general color of preserved specimens is, as in most species, dull purplish or dark brown on the upper and outer surfaces, paler and more yellowish on the lower surfaces and on the inside of the arms and web. The color varies much, as in all other cephalopods, according to the mode of preservation, strength of the alcohol, etc. In the best preserved specimens there are irregular, ill-defined blotches and spots of darker purplish brown, often longitudinal in direction, scattered over the upper surfaces of the body, head, and web, and on the sides of the body, beneath. Between these blotches the surface is rather thickly sprinkled with small, dark brown chromatophores.

In life, the color seems to be very changeable. Mr. A. Agassiz has sent me two colored drawings made by him in 1859, from a living specimen taken in the Gulf of Georgia, W. T., and kept in confinement. In one of these drawings the color of the dorsal surface of the body, which is represented as nearly smooth, is purplish red, mottled and streaked with dark brown and with a longitudinal band of brown along the sides, running back from the eyes; the upper and front sides of the web and arms are dull purplish red, irregularly mottled with dark brown; the bases of the ventral arms, with the web between them, and the lower surfaces of the head, have a lighter orange tint. In the other drawing (a side view) the whole surface of the body and head is represented as covered with large and prominent, irregularly wavy folds and ridges, separated by deep wrinkles; the folds are larger posteriorly, but project as irregular warts, both on the back and on the ventral surfaces. The colors of the body and head, in this figure, are dark and rather bright; the upper parts are mottled and streaked with lake-red, dull orange, dark brown, and grayish green, the dark brown and red tints predominating; the lower surfaces are lighter, but similarly mottled, with the orange and lake-red tints most conspicuous; the siphon and edges of the gill-opening are orange-yellow, the latter bordered with dark brown; eyelids brownish red; eyes silvery.

According to the drawings referred to, the body, in life, is swollen and pyriform or ovate, much broader and thicker than the head. In one of the figures there appears to be a membranous fold running along the sides and forming a posterior prominence at the end of the body; in this figure the membranous folds along the sides of the arms are represented as much wider and extending nearer to the ends than in the preserved specimens.

Mr. William H. Dall, who has observed this species in life, furnishes the following notes on its habits: "When angry the horn over the eye is erected, the arms coil together, the eye dilates, and the body quivers with rage. The muscles keep up a squirming motion, but I have never seen any approach to the dark color figured by Chenu as characteristic of the angry *Octopus vulgaris* of the Mediterranean, nor any such elevated longitudinal ridges. The suckers project or are retracted according to the mood of the animal; their outer edge expands when about to seize hold, and contracts after getting hold of anything. In very large individuals the extremities of the arms are long and much attenuated. I suppose they can adjust their shape to their quarters, but when in motion the body is round and always *on top* and the oral disk is invisible. It never willingly turns its mouth up, and when forced to do so clinches its arms, like a fist, over it. With death comes flaccidity and flattening. One with a body 8 inches in diameter had the arms 16 feet long. They shrank much in alcohol."

Measurements of Octopus punctatus Gabb, in millimeters.

	Nat. Mus., No. 33076 ♂.		M. C. Z., No. 62 ♂.	
Length of body to eye,			229	
From edge of mantle to tip of tail (below),			153	
Breadth of body,			140	
Breadth of head, at eyes,	70		66	
Breadth of head, at base of arms,	82.5		89	
Diameter of eyeball,	25.5		28	
Eye to web between ventral arms,	203			
Eye to web between 3d and 4th arms,	165			
Eye to web between 2d and 3d,	178			
Eye to web between 1st and 2d,	153			
Mouth to edge of web between dorsal arms,	114		165	
Mouth to edge of web between 1st and 2d,	178		216	
Mouth to edge of web between 2d and 3d,	178		216	
Mouth to edge of web between 3d and 4th,	216		229	
Mouth to edge of web between ventral arms,	153		114	
Length of siphon, lower side,	70		106	
Diameter of siphon, near base,	38		33	
Diameter of siphon, at tip,	13		15	
	Right side.	Left side.	Right side.	Left side.
Length of dorsal arms (1st pair),	485	672	915	953
Length of lateral arms (2d pair),	648	699	965	978
Length of lateral arms (3d pair),	533	673	737	965
Length of ventral arms (4th pair),	737	635	838	915
Breadth of 1st pair of arms,	32		25.5	
Breadth of 2d pair of arms,	35.5		25.5	
Breadth of 3d pair of arms,	38		25.5	
Breadth of 4th pair of arms,	32		21.5	
Diameter of largest suckers, 2d and 3d pairs of arms,	20 to 25.5		18	
Diameter of central pit,	6		3	
Diameter of largest suckers on dorsal arms,	19 to 23		18	
Diameter of largest suckers on ventral arms,	19 to 20		15	
Length of terminal organ on hectocotylized arm,	71		71	
Diameter at base,	6		6	

This species has a wide range along the Pacific coast. It extends from San Francisco to Sitka, Alaska. On the coast of Alaska it is smoked and dried by the Indians as an article of food. In the markets of San Francisco it is often sold fresh, to the French and other foreigners, for food.

Octopus bimaculatus Verrill, sp. nov.

Plate V. Figs. 1, 1 a. Plate VI.

Size moderate, body relatively large, elongated pyriform, enlarged posteriorly, somewhat depressed in alcoholic specimens. Upper surface everywhere covered with prominent, unequal, raised warts, usually conspicuous in preserved specimens, except in those which are unusually flaccid, in which they sometimes become low, rounded, or flattened, but do not entirely disappear. On the ventral surface the warts are much smaller and less conspicuous. Head large, not so broad as the body, from which it is separated by a slight constriction; sides of the head about the eyes prominent. Eyes large. Upper surface and sides of the head conspicuously warted like the body, or more coarsely than the body; above and a little behind the eyes there is one large, conical, warted cirrus; in front and around this, above the eye, there are numerous large, prominent warts, some of them larger than those on the general surface. Arms rather long, moderately stout, united at the base for a considerable distance by a strong thick web, the upper surface of which is strongly warted, like the head and body. The web is much more extensive between the dorsal arms than between the ventral ones, usually broadest between the second and third pairs. The lower surface of the web and the sides and ventral surface of the arms are covered with very numerous, crowded, minute, conical or granule-like warts, which often appear to be arranged in small patches or clusters separated by smoother, paler, reticulated lines or wrinkles. Arms unequal, the dorsal pair considerably smaller and shorter than the others. The second and third pairs are very nearly equal in size and length. The fourth pair is a little smaller and shorter, but considerably longer than the dorsal pair. The arms are rounded trapezoidal toward the base, with the sucker-bearing face broad and the dorsal surface well rounded; the membrane along the sides of the arms in continuation of the web is usually narrow and inconspicuous, and can often be traced only for a short distance. The suckers toward the bases of the arms are large, broad, saucer-shaped, with strong radiating grooves, about thirty in number, and with a large and deep central pit. Margin much expanded, with two borders, the outer one soft and finely crenulated, the inner one divided into lobes by radiating grooves. In some males examined, one sucker within the border of the web is very much larger than any of the others on the second and third pairs of arms. This enlarged sucker is the twelfth from the base, and in the posterior row on each arm. One male of large size has the corresponding sucker only a little larger than the adjacent ones, but the two pairs of lateral arms in the males have ten or twelve suckers (from about the tenth to the twentieth suckers) mostly within and near the edge of the web decidedly larger than the corresponding ones on the dorsal and ventral arms. Beyond the edge of the web the suckers rapidly diminish in size, and on the distal half become relatively small, and gradually decrease to the very small ones which cover the attenuated tips. The large suckers toward the base of the arms are but little elevated, and have very broad bases; they alternate regularly, and their borders are nearly or quite in contact. The three suckers next the mouth on each arm are nearly in one line; the smaller inner ones forming a regular circle around the mouth.

In the male, the right arm of the third pair is hectocotylized. This arm is decidedly shorter than its mate, and tapers much more rapidly to the tip, which is acute; along the posterior dorsal angle of the arm there is a strong, broad membranous fold, with the lower surface strongly concave, white, and crossed by numerous distinct transverse grooves; the outer edge of the membrane is thin, sharp, white, and curves inward over the groove. The groove with its covering membrane extends close to the tip of the arm, where it terminates in a minute conical papilla; beyond this, there is a minute, conical, naked tip, but without any appearance of the spoon-shaped cavity and transverse grooves found in other species of *Octopus*.

In alcoholic specimens the entire upper surface is usually very dark purplish brown, varying to dark bluish gray. In some specimens there are obscure patches of darker and lighter over the upper surface. In all the specimens examined there is a large, rounded, purplish black spot near the base of the web, and corresponding to the interval between the second and third pairs of arms. Lower surface of the body, head, and web much lighter than the upper surface, dull grayish or yellowish white, finely specked with purplish chromatophores. Terminal portion of the siphon darker, much like the dorsal surface, inner surface of the web and arms grayish purple, paler than the upper surface. Inner surface and rim of the suckers yellowish white.

The largest male observed (from San Diego, Cal.) has the dorsal arms 325 and 390 mm. long, from the mouth; second pair of arms, 540 and 450 mm. long; third pair of arms on left side, 550 mm.; right (hectocotylized) arm, 400 mm.; ventral arms, 500 and 490 mm.; greatest transverse diameter of the dorsal arms, 20 mm.; lateral arms, 25 mm.; ventral arms, 20 mm.; diameter of the larger suckers of the lateral arms, 11 to 14 mm.; of the twelfth sucker, 15 to 16 mm.; breadth of the web between dorsal arms, from the mouth, 60 mm.; between lateral arms, 70 to 100 mm.; between ventral arms, 60 mm.; length of body, 70 mm.; greatest breadth, 75 mm.; vertical thickness, 42 mm.; breadth of head across eyes, 45 mm.; breadth of dark spot at base of web, 20 mm.

A somewhat smaller male, with the tissues more contracted, has the dorsal arms 265 mm. long; second pair of arms, 270 mm. (probably reproduced) and 280 mm.; third pair of arms, 300 mm. (left side); hectocotylized arm, 265 mm.; ventral arms, 285 mm.; diameter of the twelfth sucker of the lateral arms, 20 to 22 mm.; of the adjacent suckers, 12 to 14 mm.; length of body, 70 mm.; breadth, 60 mm.; breadth of head, 45 mm.

This species has an extensive southern distribution on the Pacific coast. It is common at San Diego, California, where it has been obtained by Dr. Edward Palmer and others. Numerous small specimens were obtained at Panama and on the coast of San Salvador by Mr. Frank H. Bradley, for the Museum of

Yale College, in 1866 and 1867. The largest specimens that I have seen are two males from San Diego, Cal. These were sent to me for description by the National Museum. They were collected by Prof. D. S. Jordan. A female, of somewhat smaller size, from the same locality, was sent to the museum of Yale College by Dr. Edward Palmer.

New Haven, October, 1883.

EXPLANATION OF PLATES.

PLATE IV.

Fig. 1. *Octopus punctatus* Gabb. Male. Dorsal view, from an alcoholic specimen, somewhat restored. Reduced to one fourth natural size.

PLATE V.

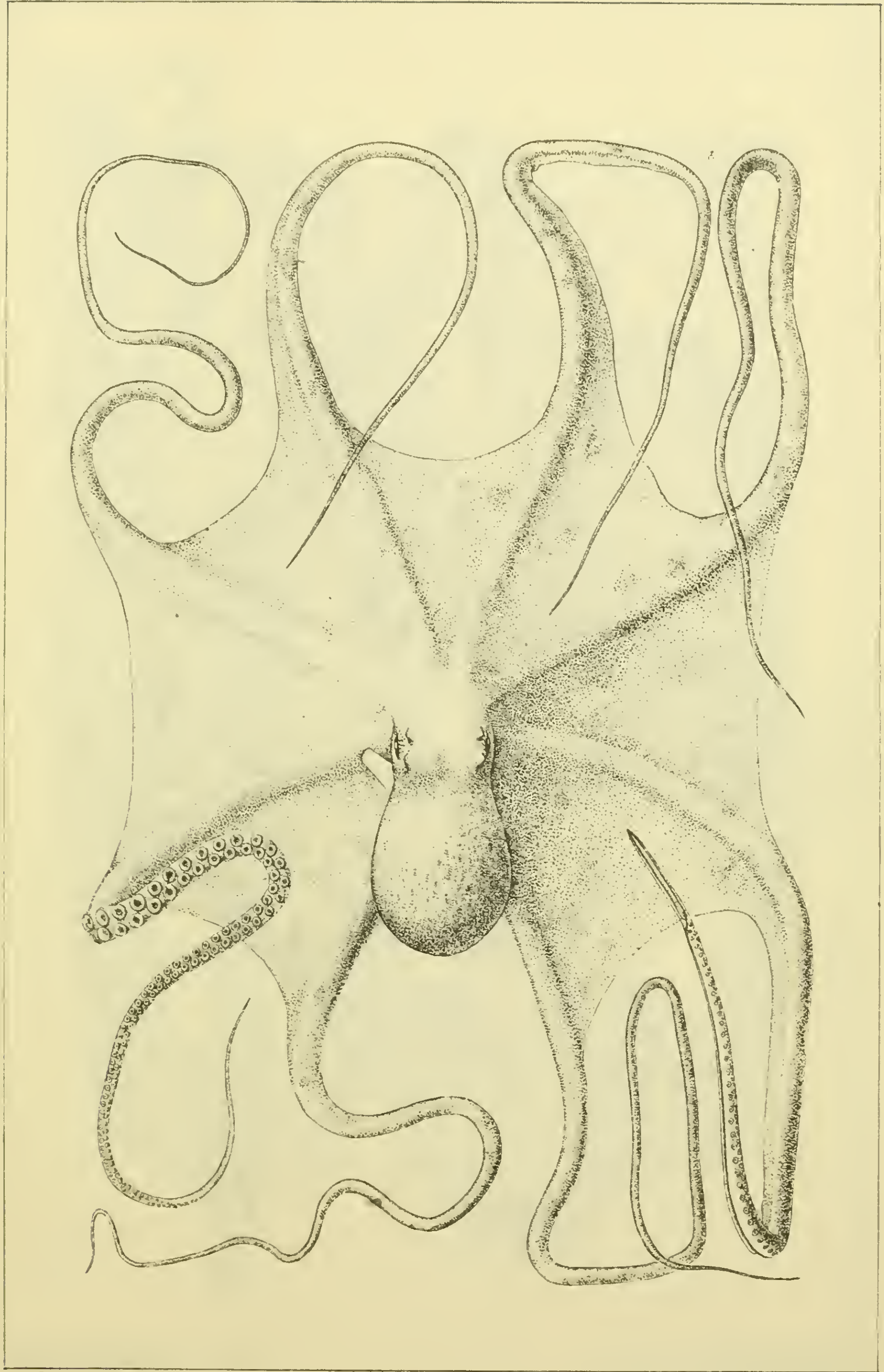
Fig. 1. *Octopus bimaculatus* Verrill. Male. Side view. One half natural size. Somewhat restored from an alcoholic specimen.

" 1 a. The same. Hectocotylized arm. Side view, showing the marginal groove spread open and the very small terminal organ. Enlarged two diameters.

" 2 *Octopus punctatus* Gabb. Distal portion of the hectocotylized arm, front view, showing the terminal organ, spread open, and the commencement of the marginal groove, with a few of the distal suckers. Enlarged two diameters.

PLATE VI.

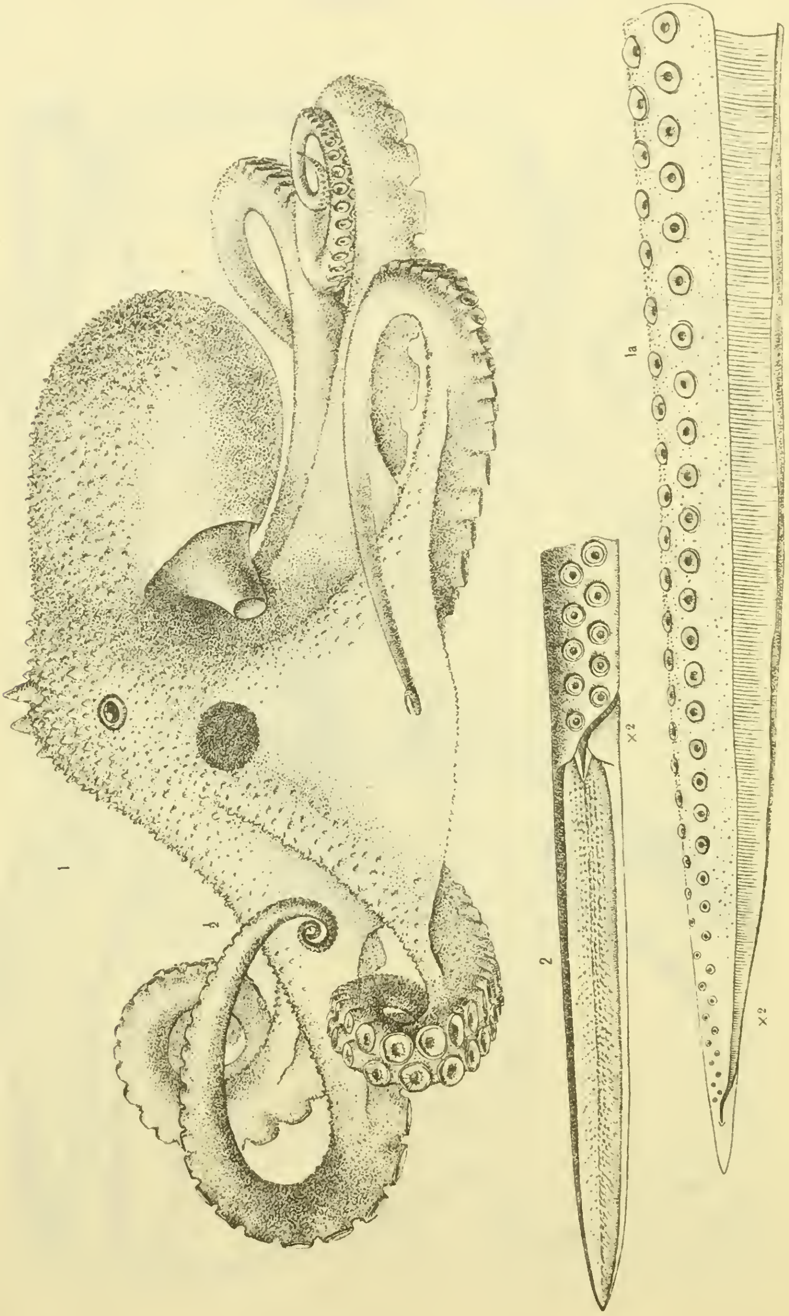
Fig. 1. *Octopus bimaculatus* Verrill. Male. Front view of the inner surface of the web and arms, showing the entire length of the right arm of the second and third pairs, and the basal portion of the other arms. To illustrate particularly the great size of certain suckers of the lateral arms.



J. H. Emerton, from Nature

Photo Lith by L. S. Punderson, New Haven, Conn

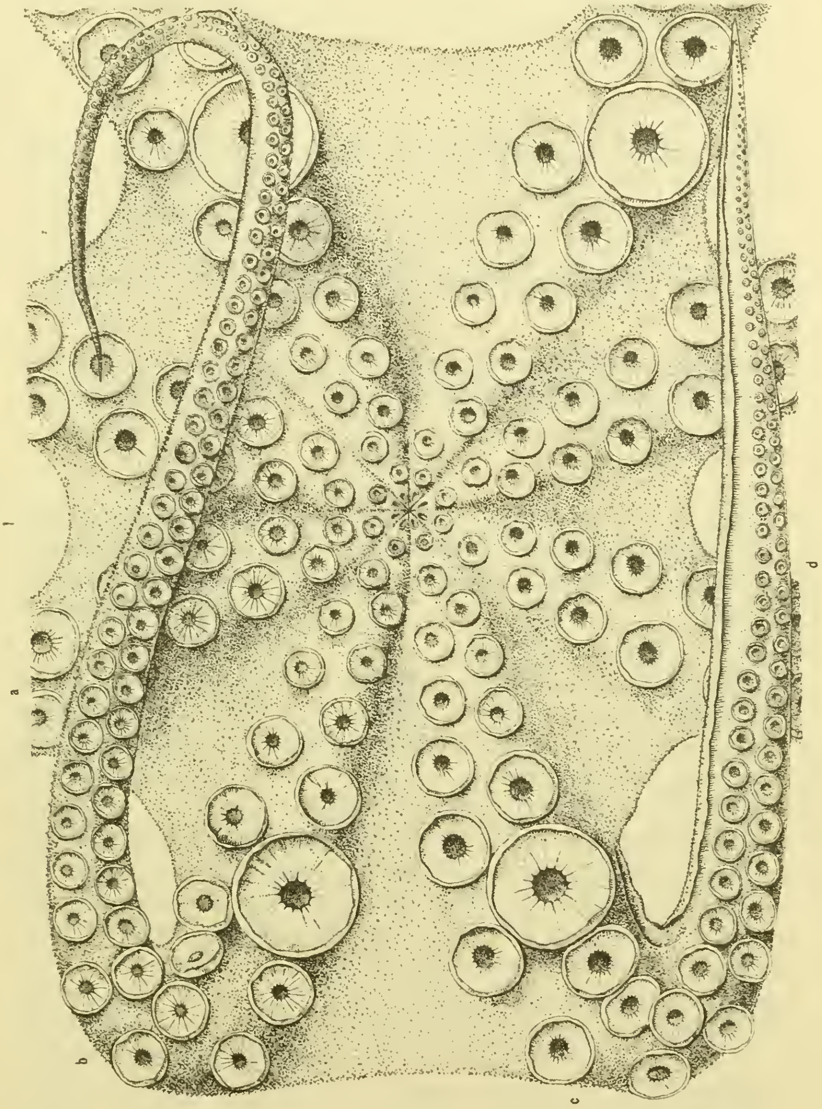
OCTOPUS PUNCTATUS GABB.



J H Emerton, from Nature.

Photo Lith by L S Punderson, New Haven, Conn

1, OCTOPUS BIMACULATUS 2, OCTOPUS PUNCTATUS



J H Emerton, from Nature
Photo Lith by L S Punderson, New Haven, Conn

OCTOPUS BIMACULATUS VERRILL.

CORRIGENDA.

Ueberall lies statt *host* — *Wirth*,
p. 127, Z. 2 von unten lies statt *T.* — *P.* Herb. Carpenter,
p. 128, Z. 2 ,, ,, ,, ,, *Blake* — *Bibb*,
p. 129, Z. 1 ,, ,, ,, ,, Stat. *23* — Stat. *203*,
p. 129, Z. 8 ,, ,, ,, ,, *der* — *des* Pharynx,
p. 130, Z. 5 ,, ,, ,, ,, *Blake* — *Bibb*,
p. 130, Z. 10 ,, ,, ,, ,, *Blake-* — *Blake- und Bibb*-Exped.
p. 131, Z. 20 ,, oben ,, ,, Längs-*Ciste* — Längs-*Leiste*,
p. 132, Z. 4 ,, ,, ,, ,, *Blake* — *Bibb*,
p. 132, Z. 12 ,, ,, ,, ,, ,, — *Corvin*,
p. 133, Z. 6 ,, ,, ,, ,, *glatt* — *platt*,
p. 133, Z. 9 ,, ,, ,, ,, *bei dem* — *beiden*.

No. 7. — *Reports on the Results of Dredging, under the Supervision of* Alexander Agassiz, *in the Gulf of Mexico* (1877–78), *and in the Caribbean Sea* (1879–80), *by the United States Coast Survey Steamer "Blake,"* Lieut.-Com. C. D. Sigsbee, U. S. N., *and* Commander J. R. Bartlett, U. S. N., Commanding.

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XXVI.

Verzeichniss der von den United States Coast Survey Steamers "Hassler" und "Blake" von 1867 *zu* 1879 *gesammelten Myzostomiden.* Von Dr. L. v. Graff, Professor of Zoölogy at the College of Forestry of Aschaffenburg (Bavaria).

In dem nächsten Bande des "Report on the Scientific Results of the Exploring Voyage of H. M. S. Challenger" wird eine von 16 Tafeln begleitete ausführliche Beschreibung der mir in den letzten Jahren von den verschiedensten Seiten zugekommenen *Myzostomiden* erscheinen. Es befinden sich darunter auch die Formen welche Herr P. Herb. Carpenter (Windsor) von den Crinoideen des "Hassler" und "Blake" ausgesucht und mir mit allen nur wünschenswerthen Notizen übersandt hat. Es sind nicht weniger als 22 Species von denen 21 neu sind. Vierzehn derselben sind dem Blake- und Hassler-Materiale eigenthümlich (ich werde sie in dem folgenden Verzeichniss mit einem * bezeichnen) während der Rest auch in dem von der Challenger-Expedition, und aus den Museen von Copenhagen, Kiel, Bergen, Leiden, etc. stammenden Materiale Repräsentanten hat.

Ohne die allgemeinen Resultate meiner Publication im Challenger-Report zu anticipiren, will ich hier nur eine kurze Beschreibung der von den Schiffen "Blake" und "Hassler" erbeuteten Formen liefern. Dieselben lassen sich folgendermaassen gruppiren: —

* Blake + Hassler specimens

AA. Typische Zwitter Myzostomen, meist mit Saugnäpfen versehen, ectoparasitisch lebend und keine Deformitäten an ihren Wirthen erzeugend.	
A. Ohne Caudalanhänge.	
I. Mit deutlichen Saugnäpfen.	
1. Rand der Körperscheibe ohne Cirren, glatt . .	**M. longipes.**
2. Rand der Körperscheibe mit Cirren.	
a. Jederseits 10 Cirren vorhanden.	
α. Cirren sehr kurz, Körper dick und undurchsichtig, meist mit gewölbtem Rücken und ohne hyalinem Randsaum	**M. areolatum.** **M. marginatum.** **M. brevipes.** **M. testudo.**
β. Cirren lang, Körper meist ein dünnes durchscheinendes Plättchen mit hyalinem Randsaum	**M. pictum.** **M. excisum.** **M. crenatum.** **M. Agassizii.** **M. vastum.**
b. Jederseits mehr als 10 Cirren vorhanden.	
α. Körper viel länger als breit	**M. oblongum.** **M. Caribbeanum.**
β. Körper kreisförmig, Länge und Breite nicht oder nur wenig verschieden . .	**M. irregulare.** **M. elegans.** **M. rotundum.** **M. abundans.**
II. Saugnäpfe fehlen	**M. carinatum.**
B. Mit Caudalanhängen und Saugnäpfen	**M. bicaudatum.** **M. filicauda.**
BB. Getrennt-geschlechtliche Myzostomen, ohne Saugnäpfe, Paarweise in Cysten ihrer Wirthe lebend . .	**M. cysticolum.** **M. inflator.** **M. Murrayi.**

* Myzostoma longipes n. sp.

Der kreisrunde ockergelbe Körper hat einen Durchmesser von 2 mm. und entbehrt der Cirren sowie eines durchscheinenden Randsaumes. Der Rücken ist mit scharfbegrenzten stumpfen Warzen besetzt. Die Muskulatur ist sehr kräftig und bauchseits tritt dieselbe als gewölbtes Muskelpolster hervor, in dessen Umkreis die grossen bis über den Rand der Körperscheibe ausgestrekten

Parapodien entspringen. Saugnäpfe rund und stark vorspringend. Mund und Cloakenöffnung ventral, subterminal. Ein Exemplar vorhanden.

Host: Incertain. Von Stat. 269 (St. Vincent) der Blake-Exp.†

* **Myzostoma areolatum** n. sp.

Das grössere der vorliegenden Individuen misst in der Länge 1.5 mm. in der Breite 0.9 mm. und stellt eine ovale, undurchsichtige, braune, lederartige Scheibe dar, die am Rande 20 sehr kurze und stumpfe Wärzchen trägt. Der Rücken zerfällt durch Längs- and Querfurchen in vierseitige bis polygonale Felder, die gegen den Rand kleiner werden und ihre longitudinale Anordnung verlieren. Im übrigen ist sowohl Rücken als Bauch flach und letzterer springt etwas vor, so dass eine schmale, dünnere Randparthie sich von der Mittelparthie absetzt, an deren vorderer Grenze ventral der Mund, an der hinteren Grenze die Cloakalöffnung liegen. Die kurzen gedrungenen und breit abgestumpften Parapodien sowie die ovalen Saugnäpfe liegen in der Mittelparthie, der auch allein die Verzweigungen des Darmes und der Geschlechtsorgane angehören.

Host: a. *Actinometra Blakei* P.H.C. von Stat. 172 (Guadeloupe) ; und b. *Act. meridionalis* var. *quadrata* P.H.C. von Stat. 203 (Martinique) und Stat. 278 (Barbados) der Blake-Exp.

* **Myzostoma marginatum** n. sp.

Der kreisförmige Körper des grösseren Individuums hat einen Durchmesser von 2 mm., ist gelbbraun gefärbt, am Rücken gewölbt und mit Warzen von sehr verschiedener Grösse besetzt. Indem die Bauchseite ebenfalls stark vorspringt und sich von dem hier vorhandenen hyalinen Randsaum scharf absetzt, erreicht der Körper eine bedeutende Dicke. Die Randcirren messen bis 0.18 mm. Die Parapodien haben eine mittlere Grösse und stehen im Kreise in der Mitte zwischen Centrum und Rand der Körperscheibe ; etwas mehr nach aussen die kräftigen runden Saugnäpfe. Mund und Cloakenöffnung liegen ventral zwischen Bauchmasse und Randsaum.

Host: Actinometra discoidea P.H.C. von Stat. 155 (Montserrat) der Blake-Exp. Ein anderes Exemplar von Stat. 203 (Martinique) stammt wahrscheinlich von demselben host.

* **Myzostoma brevipes** n. sp.

Das grössere der beiden vorliegende Exemplare hat einen Durchmesser seiner kreisrunden Körperscheibe von 2.3 mm. Die Dicke steht in der Mitte zwischen

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† Die Stationsnummern beziehen sich auf die "List of Dredging Stations occupied by the United States Coast Survey Steamers 'Corwin,' 'Bibb,' 'Hassler,' and 'Blake,' from 1867 to 1879," Bull. Mus. Comp. Zoöl., Vol. VI. No. 1, Cambridge, 1879. Die Namen der hosts sind mir von Mr. T. Herb. Carpenter nach seinen Manuscripten mitgetheilt worden, soweit sie zu ermitteln waren.

Myz. glabrum F.S.L., *Myz. cirriferum* F.S.L. Mit letzterem hat die vorliegende Species den Besitz eines hyalinen Randsaumes sowie der 20 kurzen Cirren gemein. Rücken und Bauchhaut glatt, Farbe oben lebhaft Gummigutt-gelb, unten matt graubraun. Saugnäpfe und Parapodien äusserst schwach entwickelt.

Host: Antedon Pourtalesii P.H.C. von Stat. 241 (Cariacou) der Blake-Exp.

* **Myzostoma testudo** n. sp.

So benannt, weil die mit dichtgedrängten flachen Wärzchen versehene Rückenhaut durch tiefe Längs- und Querfalten in eine Reihe von Mittelfeldern zerfällt, denen sich seitlich fünf Paare von Höckern anschliessen, so dass die Felderung ähnlich wird der des Rückenpanzers einer Schildkröte. Farbe Sepia-braun, Rücken starkgewölbt, Bauch concav mit wenig vorspringendem Muskelpolster. Die schwachen Parapodien sowie die kleinen runden Saugnäpfe stehen viel näher dem Rande als dem Centrum der Bauchscheibe. Die beiden männlichen Genitalpapillen sind grösser als die Parapodien. Mund ventral auf der Höhe der Parapodien-Insertion, Cloakenöffnung desgleichen aber näher dem Hinterrande. Die Randcirren messen bis 0.14 mm. bei einem Gesammtdurchmesser des kreisrunden Körpers von etwas über 4 mm. (bei dem grösseren der beiden Exemplare gemessen).

Host: Actinometra lineata P.H.C. von Stat. 285 (Barbados) der Blake-Exp.

* **Myzostoma pictum** n. sp.

Durchmesser des einzigen Exemplares 1.8 mm. Gestalt ähnlich dem *Myz. cirriferum* F.S.L., aber derber gebaut als dieses und am Rücken zierlich gezeichnet. Auf hellbrauner Grundlage ein gelblicher Randstreifen, drei ebensolche Längsbänder am Rücken und von diesen zur Seite ausstrahlend eine den Darmverzweigungen entsprechende helle Zeichnung.

Host: Incertain. Von Stat. 157 (Montserrat) der Blake-Exp.

Myzostoma excisum n. sp.

Charakterisirt durch einen Ausschnitt des Hinterendes der dadurch zu Stande kommt, dass die Seitentheile sich über die terminale Cloakalpapille hinaus-erstrecken. Länge in der Medianlinie 0.8 mm., der Seitentheile 1 mm. Farbe des Körpers dunkelbraun. Der Pharynx ist sehr plump und steht weit zum Munde vor. Die runden Saugnäpfe sowie die Parapodien sind massiv und gross.

Host: Antedon Hageni Pourt. gefunden durch das Schiff "Blake," 6 May, 1868, in 96 fathoms, am Alligator-Reef.

Myzostoma crenatum n. sp.

Eine der zierlichsten und regelmässigsten Myzostomen. Der Körper ist völlig kreisrund bei einem Maximaldurchmesser von 1 mm. und die stumpfen Cirren gleichlang und in gleichen Intervallen von einander angebracht. Parapodien schwach, Saugnäpfe oval und sehr gross. Die männlichen Genitalpapillen als Röhren von Parapodiumlänge ausgebildet.

Host: Incertain. Vielleicht *Actinometra meridionalis*, die auf beiden Stationen gefangen wurde, zwischen deren Ausbeute dieses Myzostoma loose gefunden wurde: Stat. 203 (Martinique) der Blake-Exp. und Capt. Cole's Dredging mit dem Amer. Telegraph Steamer "Investigator" bei St. Lucia (13° 22′ N., 61° 7′ W., 278 fathoms).

* **Myzostoma Agassizii** n. sp.

Von dieser schönen Form die ich zu Ehren des Herrn Al. Agassiz benenne, liegen nicht weniger als 22 Individuen vor. Der Körper ist ausserordentlich dünn und durchscheinend und hat in maximo 1.4 mm. Durchmesser. Die Cirren sind in äusserst feine Spitzen ausgezogen und insoferne von verschiedener Länge, als die beiden letzten Paare viel grösser sind als die übrigen (letztere messen hier durchschnittlich 0.25 mm. während eine der ersteren 0.57 mm. maas). Beine und Saugnäpfe sind sehr schwach und es scheint diese Species im Leben sich hauptsächlich mittelst der Cirren und durch undulirende Schläge mit dem Rand der Körperscheibe lebhaft bewegt zu haben, wie daraus zu schliessen ist, dass die meisten Exemplare den Rand faltig eingeschlagen haben.

Host: a. *Antedon Hageni* Pourt. von Bahia Honda (4 May, 1868, 100 fathoms) und wahrscheinlich auch auf Stat. 32 (1877) der Blake-Exp.

b. Auf Stat. 155 und 269 der Blake-Exp. kommt *Ant. Hageni* nicht vor und es war hier wahrscheinlich *Antedon spinifera* P.H.C. der host.

Myzostoma vastum n. sp.

Die Grösse der Parapodien und Saugnäpfe sowie der Pharynx, namentlich aber die Länge und Dicke der stumpfen Cirren geben dieser Species ein sehr plumpes Ansehen. Von den letzteren sind die ersten beiden und letzten beiden Paare am mächtigsten (bis 0.6 mm. lang und 0.06 mm. breit), die übrigen Cirren erheblich kleiner (ca. 0.2 mm.). Der Körper ist etwas länger als breit (1.7 mm. : 1.47 mm.) und hat einen sehr schmalen Randsaum.

Host: *Actinometra Blakei* P.H.C. von Stat. 39 der Blake-Exp. Dieselbe Actinometra war wahrscheinlich auch der host auf Stat. 23 der Blake-Exp.

* **Myzostoma oblongum** n. sp.

Das einzige vorliegende Exemplar maas 1.7 mm. Länge, 1 mm. Breite; beide Enden sind abgerundet; der breite, ganz durchsichtige Randsaum trägt 44 fingerförmige Cirren von 0.045–0.18 mm. Länge. Farbe schwach-gelblich.

Host: Wahrscheinlich *Actinometra meridionalis* var. *carinata* P.H.C. von Stat. 249 (Grenada) der Blake-Exp.

* **Myzostoma Caribbeanum** n. sp.

Eine schmutzig-gelbbraune Scheibe von 1.2 mm. Längs- und 1 mm. Querdurchmesser. Der wenig durchscheinende Rand trägt 43 stumpfe Cirren in allen Grössen abstufungen von unscheinbaren Wärzchen bis zu 0.09 mm. Länge und ohne regelmässige Abwechslung von längeren und kürzeren. Das Hinterende trägt eine unpaare Mediancirre. Parapodien sehr schwach, Saugnäpfe klein und rund.

Host: Incertain. "Blake" 1877–78 or 1878–79, Caribbean Sea (label lost).

Myzostoma irregulare n. sp.

Unter diesem Namen vereinige ich eine Anzahl Myzostomen von wenig über 1 mm. Durchmesser der dünnen mit durchsichtigem Randsaum versehenen Körperscheibe. Sie haben das gemeinsam dass sich ihre Cirren in 20 grössere Hauptcirren und in kleinere (zum Theile warzenförmige) Nebencirren eintheilen lassen, welche letzteren zwischen ersteren zu 1 oder 2 eingepflanzt sind. Doch ergeben sich Unterschiede in der relativen Länge der Cirren sowie in dem Vorhandensein oder Fehlen von unpaaren Mediancirren am Vorder- oder Hinterende oder an beiden zugleich.

Hosts: Actinometra meridionalis A. Ag. sp. und *Act. merid.* var. *carinata* P.H.C. von verschiedenen Stationen der Blake-Exp. (W. of Tortugas, 16 Jan. 1869. — No. 45, 1877–78. — Caribbean Sea, 1877–78 or 1878–79. — Stat. 200, Martinique. — Stat. 249, Grenada.)

Myzostoma elegans Graff.

Ein Exemplar dieser von mir schon früher † beschriebenen Species fand sich auf *Actinometra meridionalis* A. Ag. sp. April 3, 1869, off French Reef, Blake Exped.

* **Myzostoma rotundum** n. sp.

Ein kreisförmiges dünnes und durchscheinendes Plättchen, am Rande schmutzig-gelb in der Mitte bräunlich gefärbt, von 0.832 mm. Länge und

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† "Das Genus Myzostoma," Leipzig, 1877, p. 12, Taf. X. Fig. 1–3.

0.88 mm. Breite. Am Rande zählt man 51 kurze (höchstens 0.08 mm. lange) stumpfe Cirren. Die Parapodien sind schwach, die runden Saugnäpfe gross. Der Darmkanal mit seinem grossen Pharynx ist sehr deutlich zu sehen und entsendet jederseits 5 baumförmig verzweigte Äste.

Host: Wahrscheinlich *Actinometra meridionalis* var. *carinata* P.H.C. von Stat. 249 (Grenada) der Blake-Exp.

* Myzostoma abundans n. sp.

Länge 3 mm., Breite 3.2 mm. Die braune von den kurzen Parapodien umgränzte Mittelparthie ist umgeben von einer gelben Zone in der die Endverzweigungen des Darmes liegen, worauf zu äusserst der ganz helle Randsaum folgt. Dieser trägt an 100 stumpfe Cirren von 0.046–0.14 mm. Länge. Die ovalen Saugnäpfe sind von auffallender Grösse.

Host: Actinometra pulchella Pourt. sp. von Stat. 210 (Martinique) und 224 (St. Vincent) der Blake-Exp. Ein von Stat. 269 stammendes Exemplar war wahrscheinlich auch an der genannten Actinometra-Species angeheftet.

Myzostoma carinatum n. sp.

Das einzige der Saugnäpfe entbehrende Myzostoma unter dem Blake-Materiale. Es ist über 2.5 mm. lang, hellgelb, von der Dicke eines ausgewachsenen *Myz. cirriferum* F.S.L., und wie dieses mit 20 Cirren besetzt. Doch mangelt ein hyaliner Randsaum. Den Rücken ziert eine erhabene Längs-Ciste von der 7 Paar seitlicher Rippen zum Rande abgehen. Die Parapodien sind sehr schwach. Mund und Cloakenöffnung liegen subterminal.

Host: Actinometra pulchella Pourt. sp. von Stat. 193 (Martinique) der Blake-Exp.

* Myzostoma bicaudatum n. sp.

Von Myzostomen mit Caudalanhängen war bisher bloss das von mir beschriebene *Myz. lobatum* † bekannt. Im Challenger-Report werde ich eine ganze Anzahl neuer Myzostomata caudata mit 2, 4 oder 6 Caudalanhängen beschreiben. Es stellen die Caudalanhänge, im Gegensatze zu den Cirren, hohle Aussackungen der Körperscheibe dar, in welche sich die Leibeshöhle mitsammt den Verästelungen des Darmes und der Geschlechtsorgane fortsetzt.

Myz. bicaudatum, wie auch die folgende dem Blake-Materiale entnommene hat bloss 2 Caudalanhänge.

Der fast kreisrunde, dunkelbraune, oben und unten flache Körper ist ohne die Caudalanhänge 0.45 mm. lang und trägt 20 Cirren am Rande. Die drehrunden Caudalanhänge messen von der Basis bis zu ihrem stumpfen Ende 0.3 mm., sie sind bis zur Spitze hohl und enthalten je einen Darmast. Der Pharynx ist sehr gross, Mund und Cloakenöffnung liegen subterminal, ventral, letztere zwischen den Wurzeln der Caudalanhänge. Die runden Saugnäpfe sind klein. die Parapodien schlank und weit abstehend.

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† *Loc. cit.*, pag. 19, Taf. II. Fig. 3 und 4.

Host: Actinomedra meridionalis A. Ag. sp., W. of Tortugas, 16 Jan., 1869, Blake.

* Myzostoma filicauda n. sp.

Ist etwa dreimal so gross als die ebengenannte Species und unterscheidet sich von dieser hauptsächlich durch die Form der Caudalanhänge. Diese zerfallen nähmlich in einen dicken Basaltheil der allein hohl ist und etwa $\frac{1}{7}$ des ganzen Caudalanhanges ausmacht, und einen von der Spitze des Basaltheiles entspringenden dünnen und soliden Terminalfaden, der länger ist als die Körperscheibe des Thieres.

Host: Antedon Hagenii Pourt. sp., off Sand Key, 17 May, 1867, Blake.

* Myzostoma cysticolum n. sp.

Nachdem schon *Willemoes-Suhm* † auf das Vorkommen von endoparasitischen cysticolen Myzostomen aufmerksam gemacht hatte, war ich in der Lage, an einem reichen Materiale die interessanten Beziehungen dieser Myzostomen zu ihren Wirthen darlegen und namentlich auch die eigenthümlichen Geschlechtsverhältnisse derselben studiren zu können. Indem ich in dieser Beziehung auf meine ausführliche Publication verweise, bemerke ich hier bloss, dass folgende Arten von Deformitäten durch Myzostomen an Crinoideen hervorgerufen werden : —

1. Einfache Verbreitungen der Pinnulæ durch äusserliches Einhacken ;
2. Verbreiterung der Pinnulæ mit gleichzeitiger spiraliger Einrollung derselben, wodurch eine Kammer gebildet wird, in der ein Myzostoma-Paar wohnt ;
3. Birnförmige Auftreibung der Pinnulæ, deren Innerer hohl ist und die Myzostomen beherbergt ;
4. Verschiedene Arten von hohlen Auftreibungen der Arme ; und schliesslich,
5. Selbständige Cysten, d. h. solche, die nicht durch Umbildung der Pinnula- oder Armglieder entstehen, sondern selbstständige durch Kalkablagerung erhärtende Auswüchse der Haut der Ambulacralseite darstellen. Solche Cysten kommen sowohl an den Armen wie an der Scheibe vor und alle drei cysticolen Blake-Myzostomen bilden Cysten dieser Art.

Myz. cisticolum bildet an der Ambulacralseite der Arme von *Actinometra meridionalis* var. *carinata* P.H.C. wurst- oder eiförmige Cysten von ca. 3 mm. Länge und 2 mm. Breite. Jede Cyste hat an einem Ende ein kleines Löchelchen, welches in den Cystenraum führt. Hier findet sich stets ein grosses Weibchen von 2 mm. Durchmesser und ein Zwergmännchen von 0.8 mm. Durchmesser. Der Körper des Weibchens ist ausserordentlich dick und mit seinen Seitentheilen zum Rücken aufgeschlagen. Es fehlen ihm sowohl Saugnäpfe als Parapodien (deren Stelle bloss noch durch rudimentäre, wenig über die Oberfläche vorragende Häckchen vertreten wird). Seine Leibeshöhle ist erfüllt von Eiern und nur ganz spärliche Rudimente von Hoden sind noch vorhanden, die aber, da die männlichen Geschlechtsöffnungen fehlen, nie zur Funktion kommen. Im Männchen, dessen Körper ganz dünn und glatt ist, finden sich bloss die beiden compacten Hoden und keine Spur von weiblichen Geschlechtsöffnungen. Dagegen sind die Parapodien desselben als kleine conische Erhebungen wahrzunehmen. Bei dem Geschlechtern fehlen Cirren und Mund sowie After (resp. beim Weibchen Cloakenöffnung) liegen terminal.

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† "Von der Challenger-Expedition," III. Brief, Zeitschrift f. wiss. Zool., Bd. XXV., 1875, pag. xxxi., und VI. Brief, ebendaselbst Bd. XXVI., 1876, pag. lxxix.

Host: Actinometra meridionalis var. *carinata* P.H.C., von Cape Trio, 22 Jan., 1872, Hassler- und Stat. 249 (Grenada) der Blake-Exp.

Myzostoma inflator n. sp.

Ist durch seine langgestreckte Gestalt und überaus reiche dichtgedrängte Darmverzweigungen ausgezeichnet. Auch ist das Weibchen hier platt und nicht in der Mitte so colossal verdickt wie bei *Myz. cysticolum.* Reste von Hoden wurden bei dem Weibchen dieser und der folgenden Species nicht constatirt. Länge des Weibchens 2.2 mm. bei 1.2 mm. Breite, Länge des Männchen 0.9 mm. bei 0.8 mm. Breite. Cirren, Saugnäpfe und Parapodien wie bei der vorigen Species.

Die Cysten entweder birnförmig und beweglich verbunden mit den Armen (auf *Ant. angustiradia* P.H.C. von der Challenger-Expedition) oder in ganzer Länge mit der Scheibe fest verwachsene Auftreibungen von Wurstförmiger Gestalt und 3 mm. Länge (auf *Actinometra pulchella* Pourt. sp. von Stat. 294 der Blake-Exp.).

Myzostoma Murrayi n. sp.

Diese Species ist sehr ähnlich der vorigen und unterscheidet sich hauptsächlich durch die bedeutendere Grösse (Weibchen bis 5.5 mm. Männchen 1.3 mm.) beider Geschlechter und den kreisförmigen contour namentlich des Weibchens. Die Cysten messen bis 8 mm. Länge, sind sehr schmal und langgestreckt, gegen das freie Ende keulenförmig verdickt während das dünnere Ende die Anheftung an den Armen oder der Scheibe des Wirthes bewerkstelligt.

Host: Antedon duplex P.H.C. von Stat. 269 (St. Vincent) der Blake-Expedition. Die Challenger-Expedition brachte von Stat. 170 und 192 Exemplare des *Antedon radiospina* P.H.C. und *Ant. angustiradia* P.H.C. mit, welche Cysten desselben Myzostoma aufwiesen.

Received, November 7, 1883.

No. 8. — *A Supplement to the Fifth Volume of the Terrestrial Air-Breathing Mollusks of the United States and Adjacent Territories.*

By W. G. Binney.

The following pages embody all the additional information relating to the subject which I have been able to obtain since the publication in the Bulletin of the Museum of Comparative Zoölogy, Vol. IV., of the fifth volume of the Terrestrial Air-Breathing Mollusks of the United States.

Burlington, New Jersey, July, 1883.

In the chapter on Geograpical Distribution several additions and corrections are to be made.

On p. 18 to the first list add: —

Onchidium Carpenteri.

The species are said to range over the *whole* of the Pacific Province. Some of them are only coast range species in California, not being found in the Sierra Nevada.

On p. 19 to the second list add: —

Macrocyclis Hemphilli.
Onchidium borealis.

In the Californian Region (p. 19), the range of the species is limited, as shown in the descriptive portion of the work. Most of the species are confined to the vicinity of the coast; as, —

Macrocyclis Voyana.
  Duranti.
Limax Hewstoni.
Ariolimax niger.
  Hemphilli.
  Andersoni.
Aglaia infumata.
Arionta arrosa.
  exarata.
Arionta Nickliniana.
  Californiensis.
  Traski.
  Carpenteri.
  sequoicola.
  Dupetithouarsi.
  Diabloensis.
  Stearnsiana.
Euparypha Tryoni.

Glyptostoma Newberryanum.
Pupa Rowelli.
Californica.

Onchidium Carpenteri.
Veronicella olivacea.

Still as coast species, but confined to islands, are: —

Arionta intercisa.
Ayersiana.
Kelletti.

Arionta ruficincta.
Gabbi.
Binneya notabilis.

In the Sierra Nevada are found: —

Vitrina Pfeifferi.
Zonites Whitneyi.
chersinellus.
Gonostoma Yatesi.

Polygyra Harfordiana.
Aglaia Hillebrandi.
Arionta Mormonum.

Both in the coast counties and Sierra Nevada are found: —

Ariolimax Californicus.
Triodopsis loricata.

Arionta tudiculata.

The last species near the coast only between San Buenaventura and San Diego.

Pupa corpulenta is incorrectly referred in the lists to the Pacific rather than Central Province.

On p. 21, in the first list add: —

Macrocyclis Hemphilli.

In the second: —

Onchidium Carpenteri.

To the list on p. 22 add: —

Onchidium Carpenteri.
borealis.

Macrocyclis Hemphilli.

And omit *Pupa corpulenta*, a species restricted to the Central Province. This last species is to be added to the list on p. 24.

To the list on p. 33 add: —

Zonites petrophilus.
Wheatleyi.
Rugeli.
Lawi.
cuspidatus.

Zonites macilentus.
Andrewsi.
Patula Bryanti.
Helicodiscus fimbriatus.
Mesodon Andrewsi.

To the list on p. 37 add: —

Triodopsis Levettei.

Triodopsis Copei.

Glandina truncata, Gmelin. (p. 84.)

Found also in North Carolina.

Glandina Texasiana, Pfeiffer. (p. 87.)

Found also in Louisiana.

Macrocylis Voyana, Newcomb. (p. 93.)

A smaller variety of 9 mm. greater diameter is found at Los Angeles.

Macrocylis Hemphilli, W. G. Binn.

Plate II. Fig. M.

At Olympia, Oregon, Mr. H. Hemphill collected several specimens of a *Macrocyclis*, which appears to be distinct from, though nearly allied to, *M. Vancouverensis*. It may be best described by saying that

The umbilicus is narrower and not excavated so much, the termination of the last whorl not receding from the umbilicus as in all the forms of *Vancouverensis* and *concava*: in all, the whorls are more or less strongly striated within the umbilicus, often almost ribbed in *concava;* not so in this shell; the texture of the shell is glassy like *Hyalina*, and there is no trace of the microscopic spiral lines found in all the other forms; beneath, the last whorl is proportionately wider. The greater diameter is 14 mm.; lesser, 10; height, 5.

The jaw and lingual dentition are as usual in the genus. I could not distinguish the characters of the central tooth in this species.

Zonites capnodes, W. G. Binn. (p. 98).

Plate III. Fig. C.

Living specimens received from near Knoxville, Tenn., through the kindness of Mrs. George Andrews, have enabled me to figure the genitalia. The genital bladder (*g. b.*) is large, globular, on a short, narrow duct: the penis-sac (*p. s.*) has the same peculiar accessory process which I have detected in those of *Z. lævigatus*, *Rugeli*, *fuliginosus*, *friabilis*, and *inornatus*. There is a vaginal prepuce.

It is in many individuals more easy to distinguish *capnodes* from *fuliginosus* by the dentition than by the shell.

Zonites fuliginosus, Griff. (p. 100.)

In a specimen from Indiana, sent me by Mr. F. Stein, I find the same accessory process to the penis-sac noticed above. It is not given in Leidy's figure in Vol. I.

Zonites Rugeli W. G. Binn.

Plate II. Figs. H, I. Plate III. Fig. D.

Shell depressed globose, perforated, thin, delicately wrinkled, the apical whorls sometimes striate, greenish horn-colored, dark smoky above; spire slightly elevated, apex flat; whorls 6, slightly rounded, the last globose, scarcely excavated at the perforation; aperture large, rounded, oblique; peristome simple, thin; ends slightly approaching; the columellar one scarcely broadened. Diameter, larger, 19 mm.; lesser, 15 mm.; height, 9 mm.

Zonites Rugeli, W. G. Binn., Ann. N. Y. Acad. Sci., Vol. I. No. 2, p. 357, Pl. XV. Fig. H, Pl. XIV. Fig. D, 1879.

Roan Mountain, Mitchell Co., North Carolina. Mrs. George Andrews.

When first received, I believed this to be an extremely globose form of *Z. inornatus*, but an examination of the lingual dentition showed this to be impossible.

I have given a figure of the genitalia. It will be seen that the accessory part of the penis-sac is in this species continued to a point beyond the retractor-muscle: otherwise the genitalia are very similar to these of *capnodes*, *friabilis*, *inornatus*, *lævigatus*, and *fuliginosus*.

Jaw as usual in the genus. Lingual membrane as usual: teeth 38–1–38. There are about 4 or 5 laterals; the 8th is a pure marginal on either side of the central line. It will be seen that *inornatus*, *subplanus*, and *lævigatus* are peculiar in having no perfect lateral teeth, but only transition teeth: *fuliginosus*, *capnodes*, and *friabilis*, as well as *Rugeli*, have well-formed laterals, differing in number in the various species: thus the lingual dentition in this group is a good guide in distinguishing the species.

The animal is dark slate-colored: the caudal mucus-pore is a longitudinal slit, as in *suppressus*.

Some individuals have their apical whorls striate, as in *Z. subplanus*.

Zonites lævigatus, Pfeiffer. (p. 102.)

The caudal mucus-pore seems to be round, and not a simple longitudinal slit as in *Z. capnodes*. *friabilis*, *fuliginosus*, *Rugeli*, and *inornatus*.

The globose variety shares with the type the peculiar lingual dentition.

Zonites demissus, Binney. (p. 104.)

Found also at Cedar Keys, Florida, and Texasana, Texas.

From the mountains of North Carolina and Tennessee I have received a gradual series of size from the typical *demissus* to *acerrus*.

Zonites intertextus, Binney. (p. 106.)

I have received it from Texas.

Zonites subplanus, Binney. (p. 107.)

Plate II. Fig. J.

This rare species has lately been found on Roan Mountain, Mitchell Co., North Carolina, by Mrs. George Andrews.

The dentition (see plate) is the same as in *Z. inornatus.*

The shell from Roan Mountain is very dark, almost black. Wyoming Co., Pennsylvania (J. S. Phillips).

Zonites sculptilis, Bland. (p. 109.)

Found also at the mouth of Laurel River, Wilby Co., Kentucky (A. G. Wetherby).

Zonites cerinoideus, Anthony. (p. 111.)

Zonites cuspidatus, Lewis, is a variety of *Z. gularis,* or a distinct species. See below, p. 143.

Zonites cellarius, Müller. (p. 111.)

St. Louis (L. B. Case).

Zonites Whitneyi, Newcomb. (pp. 113, 432.)

Plate III. Fig. L.

The dentition is figured on the plate referred to.

Zonites viridulus, Menke. (p. 115.)

Portland, Oregon (H. Hemphill).

Zonites indentatus, Say. (p. 116.)

To the synonymy add : —

Hyalina subrupicola, Dall, Bull. U. S. Geol. and Geogr. Survey of the Territories, Vol. III. No. 1, p. 163, Fig., April, 1877.

A copy of Dr. Dall's description and figure are here given (the latter on Pl. IV. Figs. H, I) : —

Of the following species, described by Mr. W. H. Dall, several examples occurred. Specimens were sent to Mr. W. G. Binney, who regards it as "apparently an albino variety of *Zonites indentata.*" Specimens were submitted to Prof. J. S. Morse, who judged it to be quite distinct from *Z. indentata.* Other specimens were sent to Mr. Dall, who describes it as a new species, and has kindly prepared the following notice.

HYALINA SUBRUPICOLA, n. sp. (Fig. 7).

This little shell is best described by a comparison of its various characteristics with those of *H. indentata*, Say, as given by Mr. Binney in his Land and Fresh-water Shells of the United States (Part I. p. 35).

H. subrupicola, while exhibiting radiating lines of growth, some of which are more conspicuous than others, does not show any such well-marked grooves or indentations as are figured by Morse (Land Shells of Maine) in *indentata*, and which form its most striking character. The former has five and a half whorls, with a greatest diameter in the largest specimen of 0.14 inch, while *indentata* has but little more than four, with a diameter of 0.20 inch. The former is perfectly pellucid, while the latter has a peculiar whitish spermaceti-like lustre. *H. subrupicola* has the last whorl smaller proportionally than *indentata*, and in fact the increment of the whorls in the former is much more regular and even. The umbilicus in both is precisely similar.

The animal of *subrupicola* varies from whitish to slaty ; the granules of the upper surface of the foot are remarkably coarse and well marked. The tentacles are, as contracted in alcohol, hardly perceptible ; the eye-peduncles are from the same cause not extended, but appear to be as usual in the genus, and to possess normal ocular bulbs. The office filled by these, however, being quite as much of a tactile nature as for purposes of sight, the usual rule in regard to the blindness of most cave animals does not apply in the case of the *Helicidæ.* With the exception of *H. indentata*, this species does not seem very near to any of the described American species, and it is totally dissimilar to *Ammonitella Yatesii*, J. G. Cooper, a remarkable form found in caves in Calaveras County, California.

Hab. — Cave in Utah. Collected by Dr. A. S. Packard, Jr., of Dr. Hayden's Survey.

It may be noted that *H. indentata* does not appear to have been collected west of the Rocky Mountains.

Zonites petrophilus, BLAND.

Plate I. Fig. F.

T. late umbilicata, depresso-subglobosa, tenuis, nitens, translucens, albida, irregulariter striata ; sutura mediocris ; anfr. 5½–6, convexiusculi, ultimus convexior, non descendens ; umbilicus extus late excavatus, perspectivus ; apertura rotundato-lunaris ; peristoma simplex, paululo subincrassatum, sæpe roseum, margine columellari reflexiusculo.

Shell broadly umbilicate, depressed; subglobose, thin, shining, translucent, whitish, irregularly striated; suture moderately impressed; whorls 5½–6, rather convex, the last more convex, not descending; umbilicus widely excavated externally, pervious; aperture roundly lunate; peristome simple, somewhat thickened, often rose-colored, the columellar margin slightly reflected. Diameter, greater, 6mm.; lesser, 5–5¼ mm.; height, hardly 3 mm.

Zonites petrophilus, BLAND, Ann. N. Y. Acad. Sci., Vol. II., Fig., p. 369 (1883).

The Cliffs, Knoxville, Tennessee, found with *Z. Wheatleyi*, Mrs. George Andrews.

This species is, in general form, nearly allied to *Z. arboreus*, but the color is different, the striæ are more developed, and the umbilicus is much wider.

My friend, Mr. W. G. Binney, examined the dentition of *Z. petrophilus*, and favored me with notes on the subject. He found the teeth 15–1–15, with two perfect laterals, one only on each side. *Z. viridulus* has the same number of laterals, but many more marginals.

I would express my deep obligation to Mrs. Andrews for her uniform kindness and liberality in supplying me, during many years, with numerous rare and interesting species. (Bland.)

Fac-similes of the original figures are given on Pl. I. Fig. F.

Zonites Wheatleyi, BLAND.

Plate I. Fig. G.

T. umbilicata, depressa, tenuis, nitens, pellucida, fusculo-cornea, delicata striatula; spira subplanulata; sutura leviter impressa; anfr. 4½, convexiusculi, ultimus basi convexior, ad aperturam rapide accrescens, vix descendens; umbilicus pervius; apertura depressa, oblique lunaris; peristoma simplex, acutum, marginibus approximatis, callo tenui junctis.

Shell umbilicated, depressed, thin, shining, pellucid, brownish horn-colored, finely striated; spire subplanulate; suture slightly impressed; whorls little convex, the last more convex at the base, rapidly increasing at the aperture, scarcely descending; umbilicus pervious; aperture depressed, obliquely lunate; peristome simple, acute, the margins approximating, joined by a thin callus.

Greater diameter, 5 mm.; lesser, 3½ mm.; height, 2 mm.

Zonites Wheatleyi, BLAND, Ann. N. Y. Acad. Sci., Vol. II. p. 368, Fig. 1 (1883).

The Cliffs, Knoxville, Tennessee, Mrs. George Andrews; also, Tiverton, Rhode Island, J. H. Thomson.

This, with the following species (*petrophilus*), was discovered and communicated to me, in 1879, by Mrs. Andrews, who thus described the locality in which the two species were found: "The Cliffs rise up 200 feet on the south side of the river; they are very steep and rocky, face the north, are almost always shady, damp, and covered with mosses and ferns. I collected the shells on the ledges of the rocks among the dead leaves, at an elevation above the river of about 100 feet. I have not found either of the species in any other locality."

Mr. J. H. Thomson, to whom I submitted specimens, sent to me examples of the same species collected by him, "on a high rocky ledge, covered with old trees, at Tiverton, Rhode Island."

This species, *Z. Wheatleyi*, is more nearly allied to *Z. viridulus*, Menke, than to any other North American form, but differs from it, especially in the form of aperture, in the descending last whorl, and in having a wider umbilicus.

I dedicate the species to the memory of my late valued and lamented friend, Charles M. Wheatley. (Bland.)

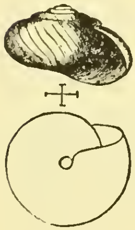
Fac-similes of the original figures are given on Pl. I. Fig. G.

Zonites Binneyanus, Morse. (p. 121.)

Vermont.

Zonites conspectus, Bland. (p. 122.)

Alaska : Salem, Oregon : Merced Co., California (H. Hemphill.)



Zonites chersinellus, Dall. (p. 123.)

Dr. Dall gives the number of whorls $4\frac{1}{2}$–5. A copy of his original figure is here given, as mine is said by him to be incorrect.

Zonites capsella, Gould. (p. 123.)

Lexington, West Virginia ; Knoxville, Tennessee (Mrs. George Andrews).

The true *capsella* has 15–1–15 teeth on the lingual membrane, two on each side of the median tooth being true laterals ; the fourth is a marginal.

Zonites placentula, Shuttl. (p. 124.)

Plate II. Fig. A.

The description in Vol. V. is a translation of that of Shuttleworth. Fig. 44 in Vol. V. represents *Zonites Lawi* (see below). The true *placentula* is here figured.

Zonites Lawi.

Plate II. Fig. E.

I propose to indicate under the name of *Z. Lawi* the form here figured and formerly considered by me as *Z. placentula*. When the limits of the species in this puzzling group are better understood, a description of *Z. Lawi* may be given.

Zonites placentula, W. G. Binn. (not of Shuttleworth), Terr. Moll. U. S., V. 124, Fig. 44, not description.

Mountains of Tennessee and North Carolina.

There is a variety in which is a heavy internal callus or plate like teeth within the aperture.

This species furnished the lingual membrane described in Vol. V. as that of *Z. capsella.*

Zonites fulvus, Müll. (p. 125.)

The dentate form sometimes has radiating rows of teeth, as in *multidentatus.*

Zonites Stearnsi, Bland. (p. 130.)

This species from the ribbed form of its jaw must be considered a *Microphysa* (see below).

Zonites cuspidatus, Lewis. (p. 113.)

Plate II. Fig. C.

This form, previously referred by me to a variety of *Z. cerinoideus*, may be considered a distinct species, or a form of *gularis.* It is not a variety of *cerinoideus* (see p. 111). The internal tooth-like processes within the aperture strongly curved one towards the other form almost an arched space. The umbilicus is closed.

Found by Miss Law in Monroe Co., Tennessee; by Mrs. Andrews on Roan Mountain, Mitchell Co., North Carolina.

Zonites macilentus, Shuttl.

Plate II. Fig. B.

Formerly I referred this to *Z. lasmodon*, but having received specimens from near Shuttleworth's original locality, I am convinced of its being distinct. The original description is given in Vol. III. p. 20.

It is found in the mountains of Tennessee and North Carolina.

Zonites lasmodon, Phillips. (p. 131).

The caudal mucus pore is erect, not the simple longitudinal slit as in *Z. suppressus* (see Fig. on p. 128).

Zonites significans, BLAND. (p. 132.)

Plate II. Fig. G.

By an unfortunate mistake another shell is figured on p. 132. That now given correctly represents the species.

Roan Mountain, Mitchell Co., North Carolina (Mrs. G. Andrews).

To synonymy add: —

Hyalina significans, HARPER, Journ. Cin. Soc. N. H., Oct., 1881, p. 258, Figs. 2, 2 a.

Zonites multidentatus, BINNEY. (p. 133.)

Plate II. Fig. F.

For comparison with the last-mentioned and following species an enlarged figure is given.

Zonites Andrewsi, W. G. BINN

Plate II. Fig. D.

The specimen figured was received from Mrs. G. Andrews, who collected it on Roan Mountain, Mitchell Co., North Carolina. It has the general appearance of *Z. significans*, *multidentatus*, and *lasmodon*, but differs so decidedly from each that I propose to designate it by the name of its discoverer. A full specific description can be given later. Compared with *Z. lasmodon*, it has fully 8 whorls, is 6½ mm. in diameter, the umbilicus 1 mm. wide, whilst *lasmodon* with 7 whorls, is 7 mm. in diameter, with an umbilicus 2 mm. wide: the Roan Mountain shell has also five parallel lamellæ, while *lasmodon* has only two, or at most three, and does not show the successive rows of lamellæ which are characteristic of *Andrewsi*, radiating from the centre.

From *Z. significans* it differs in its larger size, greater number of whorls, much wider umbilicus, and in the character of its internal denticles, which are long and winding on the wall of the whorl; while in *significans* the denticles are simply erect and conical, with broad base. The same differences distinguish it from *multidentatus*, which is still smaller than *significans*, and has a much narrower umbilicus.

Zonites Andrewsi, W. G. BINN., Ann. N. Y. Acad. Sci., Vol. I. No. 2, p. 358, Pl. XV. Fig. D, 1879.

VITRINIZONITES, W. G. BINN.

Plate III. Fig. A.

Animal heliciform, blunt before, in motion greatly acuminated behind: mantle subcentral, protected by an external shell: two longitudinal furrows above the margin of the foot, meeting over a round caudal mucus-pore : distinct locomotive disk to foot : external orifice of combined generative organs on right side of body, far behind the eye-peduncles : of respiratory and excretory organs on the right of the mantle under the peristome : jaw smooth, with median projection : lingual membrane as in *Zonites*, central teeth tricuspid, lateral teeth bicuspid, marginals aculeate.

Shell external, Vitrina-like.

The above generic name is proposed for the shell described as *Vitrina latissima* (p. 136), as it combines the characters of *Vitrina* and *Zonites*. The animal differs from *Vitrina* by having simple, not bifid, marginal teeth to the lingual membrane, and by a caudal mucus-pore, with longitudinal furrows above the margin of the foot, and by the want of an appendiculate mantle. From *Zonites* it differs only in the form of the shell, though the caudal mucus-pore seems to be circular, with projecting process when open, rather than a simple longitudinal slit, as in *Zonites suppressus*. There appears no developed appendiculate mantle process.

The genus in my arrangement will follow *Zonites*.

Vitrinizonites latissimus, Lewis. (p. 136.)

Plate I. Fig. H. Plate III. Fig. A, B.

I here add a figure of the animal in motion (Pl. III. Fig. A), not fully extended, drawn by Miss Emma Pringle. The caudal mucus-pore is circular, bordered with a narrow transversely grooved rim ; and when closed is covered completely. When open the cover is raised along its longitudinal centre into a sharp carina, leaving posteriorly, when seen from behind, an erect triangular opening. It thus differs from the simple longitudinal slit found in most of the American species of *Zonites*, such as *friabilis, capnodes, fuliginosus, inornatus, demissus, ligerus, suppressus*, the last figured in Vol. V., Fig. 47. *Z. lævigatus*, however, has a nearer approach to the circular pore of *Vitrinizonites*.

The genitalia are figured on Plate III. Fig. B. The ovary is very large (*or.*) and stout : the genital bladder (*g. b.*) is globular on a short, narrow duct: the penis-sac (*p. s.*) is very long, narrow, cylindrical, receiving the retractor muscle (*r.*) near its basal termination, and merging at its apex into the vas deferens (*v. d.*). The penis-sac has not the accessory process found in *Zonites capnodes, friabilis, lævigatus, inornatus, fuliginosus*, and *Rugeli*.

The species has been found from Carter Co. to Blount Co., Tennessee, on the dividing line between Tennessee and North Carolina.

On Roan Mountain it is usually found under damp moss.

I am indebted to Miss Annie E. Law for the opportunity of examining the specimen figured. She collected it in June, 1879, at the original locality, Bald Mountain, Blount Co., Tennessee, on dividing line with North Carolina. At Washington Co., Tennessee, it was found by Dr. Rugel. Mrs. G. Andrews found it on Roan Mountain, in North Carolina (over 6,000 feet), on the dividing line with Carter Co., Tennessee, and at Thunderhead of Smoky Mountains, North Carolina.

The lingual membrane is broad and not long; the ends are bluntly truncated. There are about 30 rows of 24–1–24 teeth each, arranged as in *Zonites.* There are six laterals, scarcely one perfect, mostly transition teeth, on each side of the central line; the seventh tooth is a marginal; the twelfth tooth is the largest. Plate I. Fig. H, shows all the teeth from the central to the first fully formed marginal, and the two extreme marginals. The dentition is nearest to that of *Zonites lævigatus.*

Limax campestris, Binney. (p. 149.)

An exhaustive paper by E. L. Mark on the Maturation, Fecundation, and Segmentation of this species will be found in Bull. Mus. Comp. Zoöl., Vol. VI. No. 12.

Limax Hewstoni, J. G. Cooper. (p. 150.)

Found by H. Hemphill, from Portland, Oregon, to San Tomas River, Lower California.

Patula solitaria, Say. (p. 156.)

I have seen one specimen from Madison, Indiana, measuring 35 mm. greater diameter.

Patula strigosa, Gould. (p. 157.)

To synonymy add: —

Helix Bruneri, C. F. Ancey, Le Naturaliste, III. p. 468, Sept. 1st, 1881. (Anguispira.)

Diam. maj. 15½ mm.; min. 14 mm.; alt. 7 mm. — Testa sordide alba, pervie lateque umbilicata, utrinque convexa, valde depressa. Spira obtusissima, latissime subconica; anfr. 5, valde convexis; grosse striis incrementi parum regularibus, costisque spiralibus crenulatis, interdum subinterruptis, supra, in anfranctibus primis præsertim, vix distinctis sculpta. Sutura marginata, impressa, subplanulata. Anfr. ult., ad peripheriam carina exserta, non acuta, munitus, costis spiralibus circa 8 subtus intructus. Apertura subemarginato-circularis, obliqua; peristomium simplex, acutum, marginibus callo tenui junctis. Testa colore sordide albo, vittis duabus brunneis ad peripheriam aliquando munita.

Montana (L. Bruner).

Cette espèce, du groupe de *L'Helix* (*Anguispira*) *Cooperi*, W. G. Binney, m'en semble réellement distincte par la carène très sensible, mais nullement aiguë de son dernier tour, les côtes spirales dont elle est pourvue surtout en dessous, par sa forme beaucoup plus déprimée, également convexe en dessus et en dessous. L'ombilic parait en proportion plus large. *L'Helix Haydeni* Gabb, en diffère par ses côtes spirales mieux marquées, très apparentes des deux côtes, sa carène plus aiguë, et son ombilic moindre. *L'H. Bruneri* présente avec *L'H. Hemphilli*, à peu près les mêmes différences qu'avec *L'H. Cooperi*. Sauf les côtes spirales, cette coquille présente les plus grands rapports de forme avec *L'H.* (*Xerophila*) *filimargo*, de la Crimée. L'ombilic et la carène sont aussi presque identiques. (Ancey.)

Patula perspectiva, Say. (p. 164.)

A carinated form is found in Union Co., Tennessee.

Patula Bryanti, Harper. (p. 165.)

Plate I. Fig. C.

Shell broadly and perspectively umbilicate, discoidal, nearly flat above, and deeply excavated below ; whorls 5, gradually increasing, regularly ribbed, outer whorl bicarinate; color light-brown ; aperture small, rhomboidal ; peristome simple, acute, having its extremities united. Greater width, 6½ mm.; least, 5½ mm. ; height, 2 mm. ; width of umbilicus, 4½ mm. (Harper.)

Patula Bryanti, Harper, Journ. of Cincinnati Soc. Nat. Hist., Oct., 1881, p. 258, Figs. 1, 1 a.

Found deeply buried under old logs on Roan Mountain, Mitchell Co., North Carolina.

I have given the original description above, and figures of one of the original specimens kindly furnished by Prof. Harper.

It may prove a carinated variety of *perspectiva*, but apparently deserves to be designated by a specific name.

Patula striatella, Anthony. (p. 165.)

Said to be found in Kamtschatka and Northern China, distinct from *pauper*, by Mollendorff. J. B. Moll. Ges., VIII. 35.

Patula asteriscus, Morse. (p. 167.)

Tacoma, Washington Territory.

Microphysa Stearnsi, Bland.

Plate II. Figs. N, O.

Olympia, Washington Territory, and Portland, Oregon. (H. Hemphill.)

As shown above, from an examination of the jaw and lingual dentition, it appears that this species is not a *Zonites*, as orignally described, but rather a *Microphysa*, like *M. Lansingi* and *M. Ingersolli.* With the former it shares the peculiarity of having a ribbed jaw and aculeate marginal teeth to its lingual membrane.

The jaw has over 19 ribs of the same type as those of *M. Lansingi* (see Pl. II. Fig. O). A portion only of the jaw is figured.

The lingual membrane (Pl. II. Fig. N) has four laterals on each side of the central tooth.

Microphysa Ingersolli, Bland. (p. 173.)

Ogden, Utah.

Onchidella Carpenteri, W. G. Binney. (p. 179.)

Body oblong, extremities bluntly rounded: upper surface regularly arched; below, quite near the edge, the border of the mantle is readily distinguished; most of the under surface is occupied by the broad, distinct locomotive disk: the body is uniformly smoke-colored; the four specimens received vary from 5 to 3 mm. in length.

Onchidium Carpenteri, W. G. Binn., Proc. Phila. Ac. N. Sc., 1860, p. 154. Land & Fresh-W. Sh. N. A., Part I. p. 308, Fig. 545 (1869).

Unfortunately omitted from Vol. V. The locality, Cape San Lucas, is doubtful. It is so referred, probably by mistake, in the volume of Land and Fresh-water Shells of North America, quoted above. There is no jaw, which renders still more peculiar the presence of one in *O. borealis;* on this account, I place the genus in *Agnatha* in the catalogue offered with this. The dentition is as in *O. borealis* (see Vol. V.). The upper margin of the base of attachment is still more prolonged in this species.

Helicodiscus fimbriatus, Wetherby. (p. 186.)

Plate I. Fig. D.

Shell light green color, discoidal or planiform, widely umbilicate, consisting of about five whorls, very gradually increasing in size. Aperture lunate, and oblique to the axis of the shell. Peristome subacute, slightly thickened, and darker than the rest of the shell, the outline somewhat sinuous when viewed from the side of the whorl. Suture deeply and regularly impressed. Umbilicus exhibiting all the volutions. Whorls ornamented with from 6 to 8 revolving ridges, terminating in a fringe-like projection of the epidermis, following this arrangement. Two or three of these ridges on the upper side of the body whorl are often of such prominence as to give that portion of the shell a fluted appearance. In old shells these epidermal fringes are somewhat worn away, leaving the ridges upon which they stood. Greater diameter, 5 mm.; lesser, 4½ mm.; height, 1½ mm.

In some specimens as many as six teeth may be observed, none of which can be seen on the aperture. (Wetherby.)

Helicodiscus fimbriatus, WETHERBY, Journ. Cincinnati Soc. Nat. Hist., IV., Dec., 1881, p. 9.

Ocoee District, Eastern Tennessee.

The figure is drawn from one of Prof. Wetherby's specimens.

Ferussacia subcylindrica, LINN. (p. 187.)

To the synonymy add: —

Cionella (*Zua*) *Morseana*, DOHERTY, Quart. Journ. Conch., I. 342, Pl. IV. Fig. 2 (1878).

Pupa armifera, SAY. (p. 205.)

I am indebted to M. de St. Simon of Toulouse for a knowledge of the lingual dentition. There are 68 rows of 14–1–14 teeth, of which 7 on each side of the median line are laterals.

Pupa contracta, SAY. (p. 207.)

To the synonymy add: —

Pupa Cincinnatiensis, JUDGE, Quart. Journ. Conch., I. 343, Fig. (1878).

FOSSIL SPECIES OF PUPA. (p. 213.)

Add: —

Anthracopupa, WHITFIELD, Amer. Journ. Sc., [3,] 21, 126, cut.

Vertigo ovata, SAY. (p. 219.)

To the synonymy add: —

Zonites Upsoni, CALKINS, Valley Naturalist, St. Louis, Vol. II. No. 4, Dec., 1880, p. 53, Fig. Home and Science Gossip, Rockford, Illinois, March, 1881.

An examination of the lingual membrane alone would prove this to be a *Zonites*. Until then I retain it in *Vertigo*, as identical with or allied to *ovata*. I have, however, on Plate I. Fig. L, given a copy of one of the original figures, leaving out the striæ, which are exaggerated in the original, and here give the original description, from which the species may be recognized, should it prove a *Zonites*.

Shell conic, thin, transparent, shining, amber-colored, umbilicated; whorls 4½, convex, very finely striated; striæ visible only under microscope. Suture distinct, aperture orbicular; peristome simple, acute, its outer termination perpendicular to the body whorl, the columellar termination reflected over the umbilicus. No internal teeth or process. Greater diameter, 1.35 mm.; lesser diameter, 1.20 mm.; length of axis, 1 mm. Locality, Winnebago Co., Illinois.

The animal not having been examined, I am unable to decide the generic character of the species with certainty; but judging from the shell I believe that it is a *Zonites*, and may be placed in the section *Conulus* of W. G. Binney's arrangement (Terr. Moll., Vol. V.). The shell resembles *A. harpa* in outline, but differs in other respects very materially. It is smaller; the texture of the shell is like that of *Conulus fulvus*. The striæ are visible only under the microscope. It is distinctly umbilicated, and the aperture is not oblique. It is no *Vertigo*. This shell, which is unlike any known *Helix*, was first discovered by Mr. Jesse B. Upson, in a damp meadow farm in Rockford, Illinois, beneath some refuse boards.

I have examined a large number of specimens under the microscope, and have made comparisons with many other species, both American and foreign, but have found none like it. There is no probability of its being an importation. The locality and surroundings forbid that.

I may mention that Messrs. Binney and Bland have examined the shell and agree that it is new. Such being the case, it is a matter of congratulation (though a surprise) to be able to add a new species to the American *Helices* from Illinois. I have the pleasure of naming the shell after the first discoverer, Mr. Upson. (Calkins.)

Mr. Upson suggests to me that the shell is the young of *V. ovata*, as it was found in company with mature specimens of that species.

Veronicella olivacea, Stearns. (p. 243.)

"Lobitos is a small creek entering the sea about forty miles south of San Francisco Bay. The ranch and hamlet through which it passes bear the same name." (Stearns.)

Specimens of the original lot found in Nicaragua have kindly been furnished me by Dr. F. W. Putnam. The jaw has over 20 ribs. The lingual membrane is as usual in the genus.

HEMPHILLIA. (p. 246.)

Plate III. Fig. II.

Animal limaciform, blunt before, swollen at centre, and greatly attenuated behind: tentacles simple: mantle subcentral, large, oval, concealing all but a small portion of an internal shell-plate: longitudinal furrows above the margin of the foot and caudal mucus-pore, over which is a hump-like process: no distinct locomotive disk: external respiratory and anal orifices at the central right margin of the mantle: orifice of combined genital system near the right eye-peduncle.

Shell-plate horny, small, unguiform, longer than wide, with posterior nucleus and concentric lines of growth, exposed in part.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, bicuspid laterals, and quadrate marginals.

Coast of Oregon.

The swollen central portion of the animal seems the first approach to a turbinate mass of viscera, separated from the foot.

This emended generic description is drawn from larger specimens (40 mm. contracted in alcohol) collected at Portland, Oregon, by Mr. H. Hemphill. Found also at Tacoma, Puget Sound, and Olympia, Washington Territory, by the same collector.

Polygyra auriculata, Say. (p. 263.)

Cedar Keys: St. George's Island, Florida.

Polygyra Texasiana, Moricand. (p. 270.)

Fort Gibson, Indian Territory.

Polygyra Dorfeuilliana, Lea. (p. 278.)

Fort Gibson, Cherokee Nation, Indian Territory: Alexandria, Louisana.

Wetherby suggests the specific name of *Sampsoni* for the variety described in Vol. V.

Polygyra pustuloides, Bland. (p. 287.)

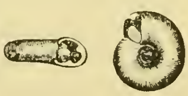
Lookout Mountain, Tennessee.

Polygyra leporina, Gould. (p. 288.)

Fort Gibson, Indian Territory.

Polygyra Harfordiana, J. G. Cooper. (p. 309.)

Fig. 203 is said by Dr. Cooper not to represent his species, but rather the Salmon River small form of *Mesodon devia* var. *Mullani*. I have, therefore, here given a figure of Dr. Cooper's original type of *D. Harfordiana* preserved at the Academy of Natural Sciences at Philadelphia. The species from this seems more nearly allied to *Polygyra* than to *Triodopsis*.



It must be remembered that my figure of the dentition (Pl. VIII Fig. R) and description of jaw were drawn from the Salmon River shell, not the typical shell found only in the Sierra Nevada region at "Big Trees."

Triodopsis vultuosa, GOULD. (p. 312.)

Plate III. Fig. J.

There are 12 ribs on the jaw. The lingual membrane has 20–1–20 teeth, 11 laterals on each side of the median line.

For the variety called *Henriettæ*, see below.

Triodopsis Copei, WETHERBY.

Plate I. Fig. J.

Shell reddish, somewhat thin, deeply striated by lines of growth, and of medium size. Spire somewhat depressed in some specimens, slightly more elevated in others. Whorls 5, transversely striated with oblique lines of growth, and increasing very gradually and regularly in size; a faint carina appearing at the junction of the upper third and lower two-thirds of the body whorl, from which the latter tapers inwardly to the base of the shell. Sutures regularly and moderately impressed. Peristome subacute, and broadly reflected outward and downward at the lower two-thirds, and bearing on its basal third an acute carina, within which is seen a prominent, vertical, double tooth, of which the outer portion is the larger. A second tooth is carried by the inner margin of the peristome at the centre of the body whorl, the point of which is in close relation to an arcuate tooth carried by the parietal wall of the aperture. Umbilicus wide, exhibiting most of the volutions. Height, 7 mm.; greater diameter, 14 mm. This size is about the average. (Wetherby.)

Helix Copei, WETHERBY, Amer. Nat., Mar., 1877, p.

Twenty miles north of Beaumont, Harden Co., Texas.

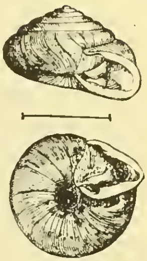
It is very like a large *vultuosa*, the aperture not produced beyond the teeth as in *Henriettæ*, but there is no trace of the callus connecting the parietal tooth with the angle of the peristome.

The figure on Plate I. is a fac-simile of that of Prof. Wetherby.

Triodopsis Henriettæ, MAZYCK.

Treated as a var. of *T. vultuosa*, p. 313. Perhaps will prove distinct.

Shell rimately umbilicated, depressed, globose, rather solid, with numerous regular delicate striæ, dark brownish horn-color; spire obtuse; whorls about five and a half, slightly convex; suture deeply impressed; beneath convex, smoother than above ; umbilicus very deep, reaching the apex, but only exhibiting the last three whorls, grooved within ; body whorl gently ascending just behind the aperture, and then suddenly and shortly deflected, very much constricted behind the peristome, with two deep exterior pits, having the space between them elevated into a prominent ridge ; aperture subtriangular, peristome much thickened within and very slightly reflexed, very tortuous, yellowish white, furnished with a small denticle near its upper termination and an erect lamelliform tooth, which is equal in length to about one fifth the diameter of the base of the shell, extending from the lower end of the uppermost pit almost to the inner edge of the body whorl ; low down in the mouth of the shell there is, between this tooth and the denticle, a large white tongue-shaped, concave tooth ; and very near this, but rather lower down in the mouth of the shell, and on the base of the body whorl, there is an oblique stout, white tooth, which is sometimes slightly cleft on the edge. The parietal wall, which is covered with a semi-transparent callus, bears a very strong, arcuated, entering, white tooth, whose outer margins form almost a right angle.



Diameter, major, $\frac{1}{2}$ inch ; minor, $\frac{1}{16}$ inch ; altitude, $\frac{1}{4}$ inch.

Eastern Texas. Mr. Jacob Boll.

This species more nearly resembles *Helix vultuosa*, Gould, than any other North American species, but differs from that shell in the shape and size of the umbilicus and in the form and armature of the aperture, which in *vultuosa* is lunate, almost circular, and in this species is rather V-shaped ; in *vultuosa* the peristome, though moderately so, is decidedly reflexed, and its plane is almost entirely unbroken ; in *Henriettæ* it is very much thickened, but scarcely at all reflexed, is very tortuous, and bears on its inner margin an obtuse denticle and a long lamelliform erect tooth, which are wanting in *vultuosa;* in *Henriettæ* the two internal teeth are so far within the aperture as to be seen only on looking into it, while in *vultuosa* they are plainly visible from the base of the side ; in the latter the parietal tooth is arched *upwards*, and its outer margin is rounded ; in *Henriettæ* it takes the opposite direction, and its margins form almost a right angle ; the deep pits behind the peristome are wanting or obsolete in *vultuosa*. (Mazyck.) The species is referred to by Mr. Bland in his "Remarks," p. 116.

To the original description of Mazyck I add a figure drawn by Mr. Arthur F. Gray from the original specimen. As stated above, Mr. Bland and myself formerly considered this as a variety of *T. vultuosa*. It seems, however, quite as worthy of specific weight as *T. Copei*.

Triodopsis loricata, Gould. (p. 313.)

Mariposa Co., California.

Triodopsis Levettei, Bland. (p. 314.)

Plate I. Fig. E.

Shell umbilicate, orbiculate-convex, thin, shining, translucent, slightly and irregularly obliquely striated, chestnut-colored, the upper whorls paler; spire scarcely elevated, apex obtuse; suture impressed; whorls 7, rather convex, gradually increasing; the last somewhat depressed at the aperture, obsoletely spirally striated, constricted behind the aperture, and slightly scrobiculated, base subconvex; umbilicus moderate, $\frac{1}{8}$ diameter of the shell, pervious; aperture very oblique, subcircular, with a well-developed flexuose, transverse white tooth on the parietal wall; peristome reflected, pale chestnut-colored, thickened within, the margins joined by a slight callus, the right margin with a white, obtuse, erect, submarginal tooth, the basal margin with two white transverse teeth, the upper one the larger.

Triodopsis Levettei, Bland, Ann. N. Y. Acad. Sci., Vol. II. No. 4, p. 116, Fig. (1880).

Near Santa Fé, New Mexico, where two living and one dead specimen were collected by my friend, Dr. G. M. Levette, who presented to me one of the former. Cabinet of Dr. Levette, and the Binney and Bland collection in the American Museum of Natural History, New York.

This species is quite distinct from any known North American or other form. The number of whorls, and of teeth, their form and color, with the color of the shell and peristome, are its peculiar features. The striæ are by no means so well developed as shown in the figures. (Bland.)

The figures are copied on my plate.

Von Martens suggests that the species may be a *Polygyra*.

Mesodon. (p. 314.)

All the specific names should have the masculine termination.

Mesodon Andrewsi, W. G. Binn. (p. 324.)

Plate II. Fig. L. Plate III. Fig. E, F.

Shell imperforate, globose, very thin, with delicate wrinkles of growth and microscopic revolving striæ; horn-color; spire elevated, conic, apex obtuse; whorls six, convex, the last greatly swollen; peristome white, thickened, slightly reflected, ends separated, the columellar one expanded. Greater diameter, 25 mm.; lesser, 20 mm.; height, 14 mm.

Mesodon Andrewsi, W. G. Binn., Ann. N. Y. Acad. Sci., Vol. I. p. 360, Pl. XIV. Fig. E, F, Pl. XV. (1879).

Roan Mountain, Mitchell Co., North Carolina. Mrs. G. Andrews. The absence of limestone on Roan Mountain accounts for the extreme thinness of the shell.

It can scarcely be said to resemble closely any known species of *Mesodon,* though perhaps somewhat like a gigantic *M. Mitchellianus.*

The jaw has sixteen ribs.

The lingual membrane (Pl. III. Fig. F) is long and narrow ; teeth 64–1–64, with about 15 perfect laterals on either side of the central line. There are no side cusps or cutting points to the central and lateral teeth, and only on the extreme marginals does a side cutting point appear. The cutting point of the marginals is long. Thus the dentition is like that of *clausus* and *thyroides.*

The genitalia are figured on Plate III. Fig. E. The genital bladder (*g. b.*) is large, oval, on a short, narrow duct : the penis-sac (*p. s.*) is long and stout, with a subcentral constriction : the prostate gland (*pr.*) is highly developed.

A dentate form is figured on Plate IV. Fig. A.

Mesodon Wheatleyi, Bland. (p. 327.)

Roan Mountain, Mitchell Co., North Carolina ; Cliff Springs, Monroe Co., Tennessee. Mrs. G. Andrews. The parietal tooth was wanting in these specimens.

Mesodon dentiferus, Binney. (p. 328.)

Plate III. Fig. G.

On Plate III. Fig. G, I have figured the genitalia of this species.

The genital bladder (*g. b.*) is small, oval, on a short duct, which is greatly swollen at a short distance below the bladder : the penis-sac (*p. s.*) is long, stout, and contracted at a short distance below its blunt end ; the retractor is inserted in the vas deferens at about the middle of its length.

In another individual, the constriction of the penis-sac was not so well developed.

Mrs. G. Andrews found at Sugar-Loaf Mountain, North Carolina, twenty miles east of Roan Mountain. a specimen of 5½ whorls ; greater diameter, 30 mm. ; lesser, 25 mm. ; height, 12 mm.

Mesodon Wetherbyi, Bland. (p. 330.)

Roan Mountain, Mitchell Co., North Carolina ; Campbell Co., Tennessee, Mrs. G. Andrews. Animal uniform slate-color.

Mesodon clausus, Say. (p. 332.)

Helix Ingallsiana. See Fischer, in Shuttleworth's Notitiæ Mal., II. 10, Pl. III. Fig. 5 (1877).

Mesodon Lawi, Lewis. (p. 335.)

Monroe Co., East Tennessee. Mrs. G. Andrews. Houston Co., Georgia.

Mesodon devius, Gould. (pp. 337, 432.)

Plate III. Fig. I.

The genitalia are here figured.

The typical form was found by Mr. H. Hemphill, at Freeport, Cowlitz Co., Washington Territory.

Mesodon Sayii, Binney. (p 339.)

Plate I. Fig. A, B. Plate II. Fig. K.

An opportunity of examining the animal of this large form of *M. Sayii*, for which I am indebted to Dr. Lewis, shows that the genital system (Pl. I. Fig. B) is similar to that of the typical form, excepting that the penis-sac is still more developed, surpassing by three times the whole genital system in length. (See Vol. I., Pl. XI. Fig. 11.)

The jaw and lingual dentition are the same as in the typical *Sayii*. I have figured on Plate I. Fig. A, the dentition of this variety.

In the mountains of Tennessee and North Carolina is found the form called *var. Chiloweensis*, one of which is figured in the plate referred to (Pl. I. Fig. K).

Aglaia fidelis, Gray. (p. 350.)

The small form from Mount Shasta, mentioned on p. 351, which also is found at the Dalles, has the same dentition and genitalia as the typical form. (See Pl. IV. Fig. G.)

There is a black variety from northern parts of California still more nearly allied to *infumata*.

Aglaia infumata, Gould. (p. 352.)

The animal is black with brick-red tubercles. Latitude 37° 30′ is said to be its southern limit. Its shell is sometimes banded. Plate IV. Fig. B, C, represent the species denuded of its hairs.

Aglaia Hillebrandi, Newcomb. (p. 352.)

Calaveras Co., California.

Arionta. (p. 353.)

The species are not well grouped in the text. The following is more natural: —

Arionta arrosa.
Townsendiana.
exarata.
*
Californiensis (including *reticulata Nickliniana, ramentosa, Bridgesi*)
*
intercisa (including *redimita*).
*
Ayersiana.
*
tudiculata.
*

Arionta Mormonum Traski.
Carpenteri.
sequoicola.
Diabloensis.
*
Dupetithouarsi.
*
ruficincta.
Gabbi.
*
Kelletti.
Stearnsiana.

The geographical distribution of the species is very peculiar. *A. Townsendiana* belongs to the Oregon fauna. I doubt its ever having been found in Tuolumne Co., California. *A. Mormonum* belongs to the Sierra Nevada counties, as does *A. tudiculata,* which also is found in southern coast counties. All the others are restricted to the coast counties, ranging as stated in the text, the following being island species: *A. ruficincta, Gabbi, intercisa, Ayersiana,* and *Kelletti. A. Stearnsiana* and *Carpenteri* are Lower Californian species.

The lingual dentition of all the species is essentially the same, excepting *Townsendiana* and *ruficincta,* which have tricuspid centrals and inner laterals. The genitalia are the same in *arrosa, exarata, Nickliniana, Californiensis, Ayersiana, tudiculata, Traski, Carpenteri, sequoicola, Diabloensis,* and *Dupetithouarsi.* From these the genitalia of *Mormonum* differ very essentially, being more nearly allied to that of *Aglaia fidelis* and *infumata. A. Townsendiana* has simple genitalia, without the accessory organs usually found in *Arionta. A. Kelletti* and *Stearnsiana* have the organs still more complicated with accessories. *A. ruficincta* and *Gabbi* are related by their genitalia to the last, but differ considerably in wanting the accessory duct of genital bladder.

I have not examined the genitalia of *intercisa.*

Arionta arrosa, Gould. (p. 354.)

J. G. Cooper, in Proc. Cal. Ac. N. S., 1875, p. 16, indicates a variety, *Holderiana,* and another variety, *Stiversiana.*

Arionta Townsendiana, Lea. (p. 355.)

The variety *ptychophora* is sometimes very thin and smooth, not malleated. I have it from Salmon River, Idaho; Bitter Root Mountains; Dalles, Oregon; Umatilla Co., Oregon. (Hemphill.) (See Pl. IV. Fig. E, F.)

Arionta tudiculata, Binney. (p. 357.)

In the Sierra Nevada from San Diego it ranges 450 miles north. J. G. Cooper says this and *A. Mormonum* are the only large species found east of the coast range.

Dr. Cooper mentions a variety, *Franki*, in Amer. Journ. Conch., V. 209. In letters to me, however, he says this is a misprint for *Traski*.

Arionta Ayersiana, Newcomb. (p. 359.)

San Clemente Island. (Yates.)

Arionta intercisa, W. G. Binney. (p. 360.)

Plate I. Fig. I.

Mr. Henry Hemphill has lately sent me alcoholic specimens, collected by him at San Clemente Island, California.

The jaw is as usual in the genus, with six separated ribs.

The lingual membrane is as usual in the genus. Teeth 31–1–31, with about 15 laterals on each side. The extreme laterals only are bicuspid. (Pl. I. Fig. I.)

The genitalia are like those figured by me for *Euparypha Tryoni*. (See Terr. Moll., V.)

From the series of specimens sent by Mr. Hemphill, I am inclined to believe *Arionta redimita* to be a variety of *intercisa*. The original specimen may have come from the same locality. Formerly I suspected *redimita* to be a variety of *ramentosa*.

Arionta Mormonum, Pfeiffer. (p. 366.)

Pl. I. Fig. K.

The small form from Dalles, Oregon, is probably a small variety of *Aglaia fidelis*. Sonora, Mexico, is given as a locality of this species, from confounding the *town* Sonora of Tuolumne Co., California, with the Mexican *state*. Mormon Island is a rocky islet in the American River, seventy miles north-northwest of this town of Sonora.

A variety is indicated as *circumcarinata* by Stearns (Ann. N. Y. Acad. Sci., Vol. I. p. , Fig., 1879). A copy of two of his figures is given on Plate I. Fig. K. It is thus described by him

Shell widely umbilicated, discoidal, flattened, angulated, with a peripheral keel; whorls six to six and a half, slightly tabulated near the sutures, which latter are deeply impressed; surface finely granulated, varying in different specimens; and otherwise sculptured by conspicuous subacute ribs parallel with the lines of growth both above and below, which meet, and sometimes cross, the peripheral keel; these ribs are more or less irregular and uneven, of varying prominence, and are also unequally spaced, being closely crowded in some places and farther apart in others. Aperture obliquely subangulate, semilunate; peristome moderately thickened, reflected somewhat, covering the open umbilicus, and made continuous by a connecting thin deposit of callus on the labium. Color, in some specimens, dingy white to white, in others a dingy reddish white, ornamented with a double revolving band, — the upper stripe being whitish, the lower reddish or light chestnut just above, and contiguous to the peripheral keel; the pinch or fold of the keel taking up what in *Helix Mormonum* is the third or lower stripe of white.

Number of specimens four, two adult and two immature, but nearly full grown.

Greater diameter, .92 to 1.01 inches; lesser diameter, .75 to .86 inch; height, .36 to .37 inch.

Animal not observed.

Stanislaus County, near Turloch, California. (Stearns).

The form to me appears a distinct species.

Arionta Diabloensis, J. G. Cooper. (p. 369.)

The species ranges one hundred miles north of Mt. Diablo. (Cooper.)

Arionta Traski, Newcomb. (p. 369.)

Dr. Cooper gives its ranges from Los Angeles fifty miles to Fort Tejon, and one hundred and fifty miles to San Luis Obispo. He says the first four whorls are hirsute.

Arionta Dupetithouarsi, Desh. (p. 370.)

In the grove at Cypress Point, Monterey.

Glyptostoma Newberryanum. (p. 374.)

The under surface of a large specimen is figured on Plate IV. Fig. D.

Macroceramus Kieneri, Pfeiffer. (p. 385.)

Mr. Bland (Ann. N. Y. Acad. Sci., Vol. II. p. 127) has shown the United States specimens to be distinct under the name of *pontificus*, Gould.

Bulimulus Schiedeanus, Pfeiffer. (p. 391.)

Plate III. Fig. K.

Jaw slightly arcuate, ends scarcely attenuated, blunt; anterior surface with 17 ribs, denticulating either margin. It is difficult to decide the exact character of these ribs. I have usually called the ribs in *Bulimulus*, *Cylindrella*, etc. narrow and widely separated. They should perhaps be described as very broad, with narrow interstices, and with a gradual increase of thickness towards their outer longitudinal margin. This plainly thickened margin is what I have formerly described as narrow ribs. In the jaw before me there is no tendency to oblique arrangement of the ribs at the upper central portion.

The lingual membrane (see plate) is long and narrow. Teeth of the same type as described by me under *Bul. dealbatus*, Say, in Vol. V.

Bulimulus multilineatus, Say. (p. 395.)

Mexico (Fischer and Crosse).

Orthalicus undatus, Brug. (p. 408.)

The upper figure of Plate LIV. is referred by Von Martens to *O. Ferussaci*.

Succinea ovalis, Gould. (p. 417.)

To the synonymy add: —

S. Calumetensis, Calkins, Valley Naturalist, Vol. I. No. 2, p. 1, with a figure. St Louis.

SPURIOUS SPECIES OF HELICIDÆ. (p. 431.)

Clausilia acrolepia, "L'Amérique Russe" is a typographical error for "L'Arménie Russe." Zoöl. Rec., 1881.

In the following list I have incorporated all the foregoing additions and alterations.

CATALOGUE

OF THE

TERRESTRIAL AIR-BREATHING MOLLUSKS

OF THE UNITED STATES AND ADJACENT TERRITORIES OF NORTH AMERICA.

PULMONATA GEOPHILA.

Agnatha.

Glandina Vanuxemensis, Lea.
    truncata, Gmel.
    decussata, Desh.
Glandina bullata, Gld.
    Texasiana, Pfr.

Holognatha Vitrinea.

Macrocyclis Vancouverensis, Lea.
    sportella, Gld.
    concava, Say.
    Hemphilli, W. G. Binn.
    Voyana, Newc.
    Duranti, Newc.
Zonites *Mesomphix.*
    capnodes, W. G. Binn.
    fuliginosus, Griff.
    friabilis, W. G. Binn.
    Rugeli, W. G. Binn.
    caducus, Pfr.
    lævigatus, Pfr.
    demissus, Binn.
    ligerus, Say.
    intertextus, Binn.
    subplanus, Binn.
    inornatus, Say.
    sculptilis, Bland.
    Elliotti, Redf.
    cerinoideus, Anth.
    Hyalina.
    cellarius, Müll.
    Whitneyi, Newc.
    nitidus, Müll.
    arboreus, Say.
Zonites viridulus, Mke.
    indentatus, Say.
    petrophilus, Bland.
    Wheatleyi, Bland.
    limatulus, Ward.
    minusculus, Binn.
    milium, Morse.
    Binneyanus, Morse.
    ferreus, Morse.
    conspectus, Bland.
    exiguus, Stimpson.
    chersinellus, Dall.
    capsella, Gld.
    placentula, Shuttl.
    Lawi, W. G. Binn.
    Conulus.
    fulvus, Drap.
    Fabricii, Beck.
    Gundlachi, Pfr.
    Gastrodonta.
    gularis, Say.
    cuspidatus, Lewis.
    suppressus, Say.
    lasmodon, Phillips.
    macilentus, Shuttl.
    significans, Bland.

Zonites Andrewsi, W. G. Binn.
internus, Say.
multidentatus, Binn.
Vitrinozonites latissimus, Lewis.
Vitrina limpida, Gould.
Angelicæ, Beck.
Pfeifferi, Newc.
Vitrina exilis, Morelet.
Limax maximus, L.
flavus, L.
agrestis, L.
campestris, Binn.
Hewstoni, J. G. Cooper.
montanus, Ingersoll.

Holognatha Helicea.

Patula solitaria, Say.
strigosa, Gld.
Hemphilli, Newc.
Idahoensis, Newc.
alternata, Say.
Cumberlandiana, Lea.
perspectiva, Say.
Bryanti, Harper.
striatella, Anth.
pauper, Gld.
Horni, Gabb.
asteriscus, Morse.
Microphysa incrustata, Poey.
vortex, Pfr.
Lansingi, Bland.
Ingersolli, Bland.
Stearnsi, Bland.
Hemitrochus varians, Mke.
Holospira Roemeri, Pfr.
Goldfussi, Mke.
Onchidella borealis, Dall.
Carpenteri, W. G. Binn.
Tebennophorus Caroliniensis, Bosc.
Helicodiscus lineatus, Say.
fimbriatus, Weth.
Ferussacia subcylindrica, L.
Cæcilianella acicula, Müll.
Stenogyra *Rumina.*
decollata, L.
Opeas.
octonoides, C. B. Ad.
subula, Pfr.
Melaniella.
gracillima, Pfr.
Pupa *Pupilla.*
muscorum, L.
Blandi, Morse.
Hoppii, Möll.
variolosa, Gld.
pentodon, Say.
decora, Gld.
corpulenta, Morse.
Rowelli, Newc.
Californica, Rowell.
Leucochila.
fallax, Say.
modica, Gld.
Arizonensis, Gabb.
hordeacea, Gabb.
armifera, Say.
contracta, Say.
rupicola, Say.
corticaria, Say.
pellucida, Pfr.
borealis, Morelet.
alticola, Ingersoll.
Vertigo Gouldi, Binn.
Bollesiana, Morse.
milium, Gld.
ovata, Say.
ventricosa, Morse.
simplex, Gld.
Strophia incana, Binn.

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Arion fuscus, Müll.
foliolatus, Gld.
Ariolimax Columbianus, Gld.
Californicus, J. G. Coop.

Ariolimax niger, J. G. Coop.
Hemphilli, W. G. Binn.
Andersoni, J. G. Coop.
Prophysaon Hemphilli, Bland & Binn.
Veronicella Floridana, Binn.
olivacea, Stearns.
Binneya notabilis, J. G. Coop.
Hemphillia glandulosa, Bland & Binn.
Pallifera dorsalis, Binn.
Wetherbyi, W. G. Binn.
Strobila labyrinthica, Say.
Hubbardi, A. D. Brown.
Gonostoma Yatesi, J. G. Coop.
Polygyra auriculata, Say.
uvulifera, Shuttl.
auriformis, Bland.
Postelliana, Bland.
espiloca, Ravenel.
avara, Say.
ventrosula, Pfr.
Hindsi, Pfr.
Texasiana, Moricand.
triodontoides, Bland.
Mooreana, W. G. Binn.
hippocrepis, Pfr.
fastigans, L. W. Say.
Jacksoni, Bland.
Troostiana, Lea.
Hazardi, Bland.
oppilata, Moricand.
Dorfeuilliana, Lea.
Ariadnæ, Pfr.
septemvolva, Say.
cereolus, Muhlf.
Carpenteriana, Bland.
Febigeri, Bland.
pustula, Fer.
pustuloides, Bland.
leporina, Gld.
Harfordiana, J. G. Coop.
Polygyrella polygyrella, Bland & J. G. Coop.
Stenotrema spinosum, Lea.
labrosum, Bland.
Edgarianum, Lea.
Stenotrema Edvardsi, Bland.
barbigerum, Redfield.
stenotremum, Fer.
hirsutum, Say.
maxillatum, Gld.
monodon, Rack.
germanum, Gld.
Triodopsis palliata, Say.
obstricta, Say.
appressa, Say.
inflecta, Say.
Rugeli, Shuttl.
tridentata, Say.
fallax, Say.
introferens, Bland.
Hopetonensis, Shuttl.
Van Nostrandi, Bland.
vultuosa, Gld.
Copei, Weth.
loricata, Gld.
Levettei, Bld.
Mesodon major, Binn.
albolabris, Say.
divestus, Gld.
multilineatus, Say.
Pennsylvanicus, Green.
Mitchellianus, Lea.
elevatus, Say.
Clarki, Lea.
Christyi, Bland.
exoletus, Binn.
Wheatleyi, Bland.
dentiferus, Binn.
Roëmeri, Pfr.
Wetherbyi, Bland.
thyroides, Say.
Andrewsi, W. G. Binn.
clausus, Say.
Columbianus, Lea.
Downieanus, Bland.
Lawi, Lewis.
jejunus, Say
Mobilianus, Lea.
devius, Gld.
profundus, Say.

Mesodon Sayii, Binn.
Acanthinula harpa, Say.
Vallonia pulchella, Müll.
Fruticicola hispida, L.
rufescens, Penn.
Dorcasia Berlandieriana, Moric.
griseola, Pfr.
Turricula terrestris, Chemn.
Aglaia fidelis, Gray.
infumata, Gld.
Hillebrandi, Newc.
Arionta arrosa, Gld.
Townsendiana, Lea.
var. *ptychophora*, A.D. Brown.
exarata, Pfr.
Californiensis, Lea.
intercisa, W. G. Binn.
Ayresiana, Newc.
tudiculata, Binn.
Mormonum, Pfr.
var. *circumcarinata*.
Traski, Newc.
Carpenteri, Newc.
sequoicola, J. G. Coop.
Arionta Diabloensis, J. G. Coop.
Dupetithouarsi, Desh.
ruficincta, Newc.
Gabbi, Newc.
Kelletti, Fbs.
Stearnsiana, Gabb.
Glyptostoma Newberryanum, W. G. B.
Euparypha Tryoni, Newc.
Tachea hortensis, Müll.
Pomatia aspersa, Müll.

* *

Cylindrella Poeyana, D'Orb.
jejuna, Gld.
Macroceramus pontificus, Gld.
Gossei, Pfr.
Bulimulus patriarcha, W. G. Binn.
alternatus, Say.
Schiedeanus, Pfr.
dealbatus, Say.
serperastrus, Say.
multilineatus, Say.
Dormani, W. G. Binn.
Marielinus, Poey.
Floridanus, Pfr.

Goniognatha.

Liguus fasciatus, Müll.
Orthalicus undatus, Brug.
Punctum pygmæum, Dr.

Elasmognatha.

Succinea Haydeni, W. G. Binn.
retusa, Lea.
Sillimani, Bland.
ovalis, Gld., not Say.
Higginsi, Bland.
Concordialis, Gld.
luteola, Gld.
lineata, W. G. Binn.
avara, Say.
Stretchiana, Bland.
Verrilli, Bland.
aurea, Lea.
Groenlandica, Beck.
obliqua, Say.
Succinea Totteniana, Lea.
campestris, Say.
Hawkinsi, Baird.
rusticana, Gld.
Nuttalliana, Lea.
Oregonensis, Lea.
effusa, Shuttl.
Salleana, Pfr.

* *

Haleana, Lea.
Mooresiana, Lea.
Grosvenori, Lea.
Wilsoni, Lea.

EXPLANATION OF THE PLATES.

The figures of shells were drawn by Mr. Arthur F. Gray; those of genitalia and lingual dentition, by W. G. Binney.

PLATE I.

Fig. A. Mesodon Chiloweensis: lingual dentition.
" B. " " genitalia.
" C. Patula Bryanti.
" D. Helicodiscus fimbriatus.
" E. Triodopsis Levettei.
" F. Zonites petrophilus.
" G. " Wheatleyi.
" H. Vitrinozonites latissimus: lingual dentition.
" I. Arionta intercisa: lingual dentition.
" J. Triodopsis Copei.
" K. Arionta Mormonum, *var.* circumcarinata.
" L. Zonites Upsoni.

PLATE II.

Fig. A. Zonites placentula.
" B. " macilentus.
" C. " cuspidatus.
" D. " Andrewsi.
" E. " Lawi.
" F. " multidentatus.
" G. " significans.
" H. " Rugeli: shell.
" I. " " dentition.
" J. " subplanus: dentition.
" K. Mesodon Chiloweensis.
" L. " Andrewsi.
" M. Macrocyclis Hemphilli.
" N. Microphysa Stearnsi: dentition.
" O. " " jaw.

PLATE III.

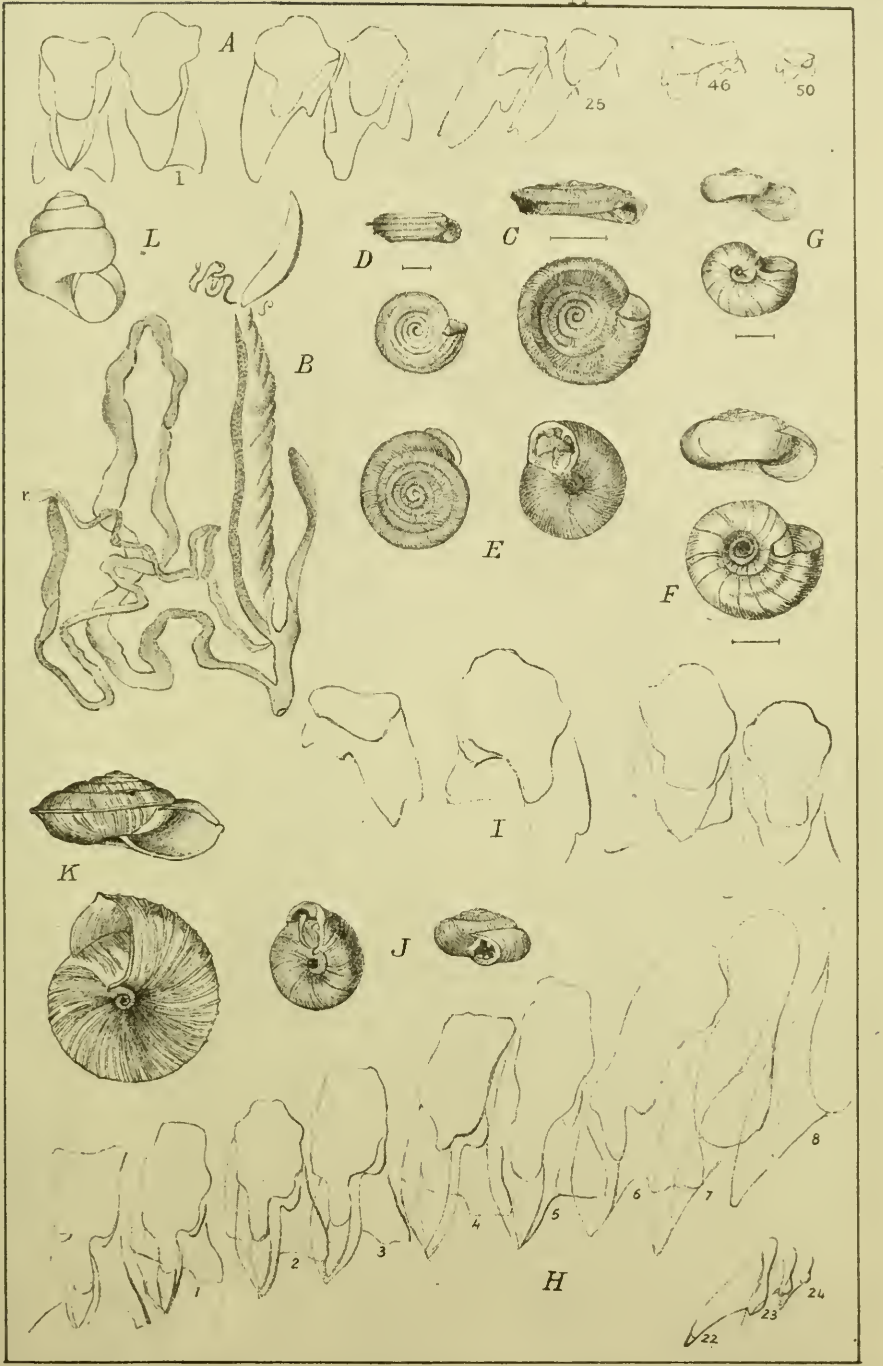
Fig.	A.	Animal of Vitrinozonites latissimus: drawn by Miss Emma Pringle.
"	B.	Genitalia of same.
"	C.	" Zonites capnodes.
"	D.	" " Rugeli.
"	E.	" Mesodon Andrewsi.
"	F.	Dentition of " "
"	G.	Genitalia of Mesodon dentiferus.
"	H.	Animal of Hemphillia contracted in spirits.
"	I.	Genitalia of Mesodon devius.
"	J.	Dentition of Triodopsis vultuosa.
"	K.	" Bulimulus Schiedeanus.
"	L.	" Zonites Whitneyi.

PLATE IV.

Fig.	A.	Mesodon Andrewsi, *var.*
"	B, C.	Aglaia infumata, denuded of hairs.
"	D.	Glyptostoma Newberryanum.
"	E.	Arionta Townsendiana, *var.* ptychophora.
"	F.	" " *var.*
"	G.	Fac-simile of original figures of Hyalina subrupicola.
"	H, I.	Aglaia fidelis, *var.*

All but B, C, and H, I, photographed from nature.

Binney: Suppl. to Terr. Moll. Plate I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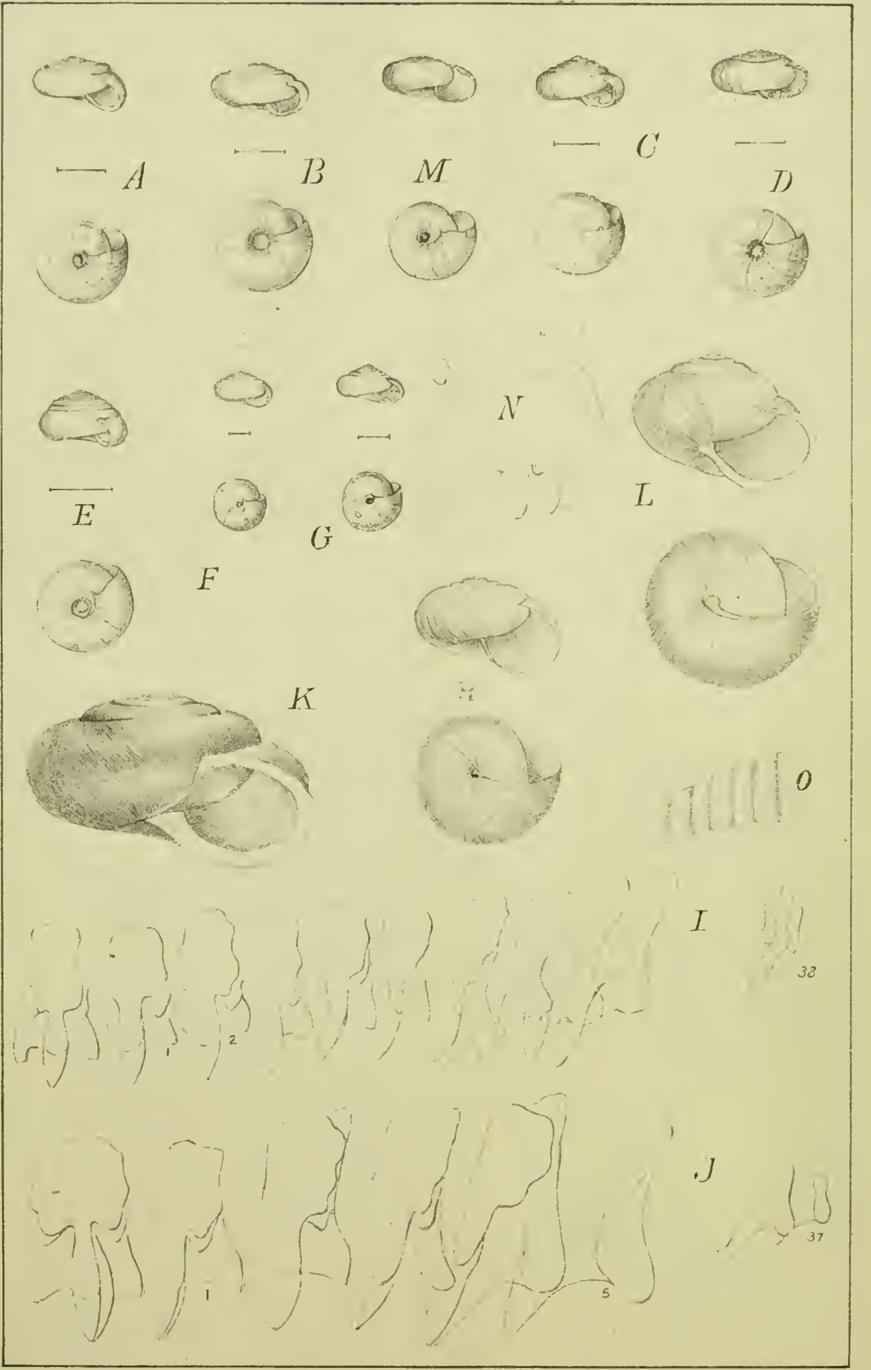
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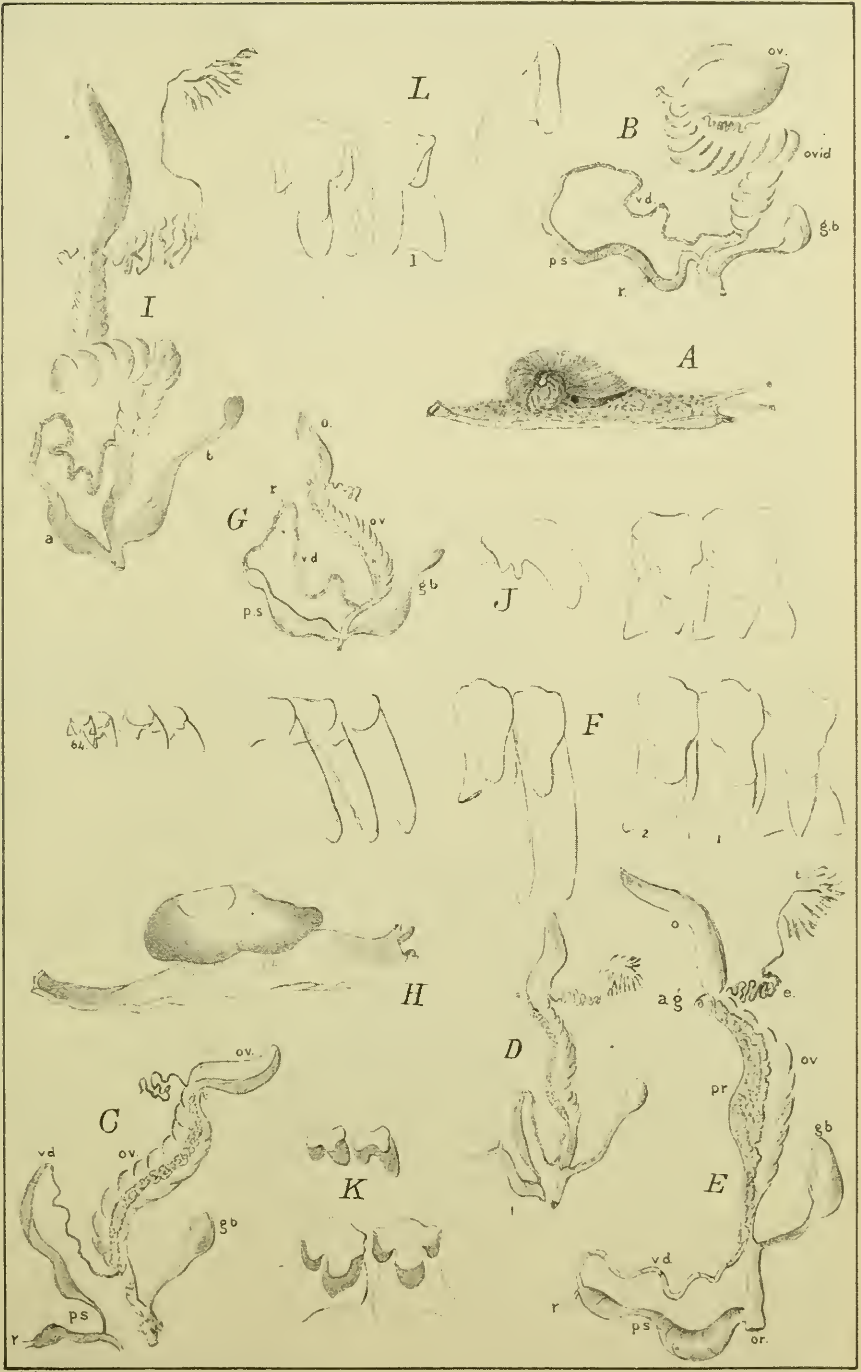
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Miss Pringle & W. G B. del.

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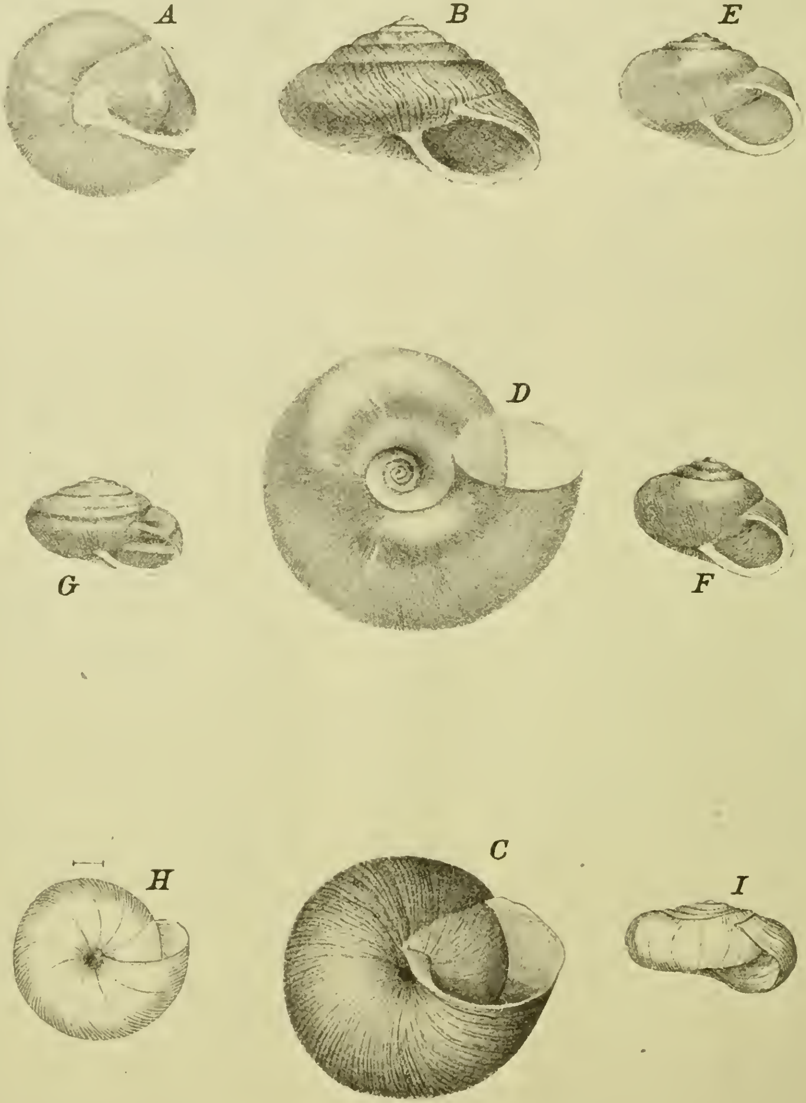
Binney; Suppl to Terr Moll. Plate IV



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No. 9. — *Studies from the Newport Marine Zoölogical Laboratory. Communicated by* Alexander Agassiz.

XIII.*

On the Development of Certain Worm Larvæ. By J. Walter Fewkes.

Prionospio tenuis Verr. (?).

Plates I. and II.

The youngest larva (Pl. I. Fig. 1, Pl. II. Fig. 7) of this worm has a transparent head and a body which is 2–3 mm. long, tapering uniformly from anterior to posterior extremity. The head (Pl. I. Fig. 1) has four eye-spots, or ocelli, each of a reddish color. Two of these are placed near the median line, and two appear near the bases of appendages called cephalic tentacles (*t*), Both pairs are situated in the dorsal walls of the head. In the cephalic walls below the median eye-spots there is a greenish spot of triangular shape. Similarly colored spots are also situated in the dorsal walls of the head under the lateral eyes.

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* The present paper, which is the first to appear under the above title, is one of a series from my Newport Laboratory, of which the following have already been published: —

I. The Development of Salpa. By Wm. K. Brooks. pp. 58. 34 cuts. March, 1876. Bull. Mus. Comp. Zoöl., Vol. III. No. 14, p. 291.
II. On the Young Stages of some Osseous Fishes. By A. Agassiz. I. Development of the Tail. pp. 10. 2 plates. 1877. Proc. Amer. Acad., Vol. XIII. p. 117.
III. The Development of Lepidosteus. By A. Agassiz. pp. 11. 5 plates. 1878. Proc. Amer. Acad., Vol. XIV. p. 65.
IV. On the Young Stages of some Osseous Fishes. By A. Agassiz. II. Development of the Flounders. pp. 24. 10 plates. 1878. Proc. Amer. Acad., Vol. XIV. p. 1.
V. On some Young Stages in the Development of Hippa, Porcellana, and Pinnixa. By Walter Faxon. pp. 16. 5 plates. April, 1879. Bull. Mus. Comp. Zoöl., Vol. V. No. 11, p. 251.
VI. On the Development of Palæmonetes vulgaris. By Walter Faxon. pp. 27. 4 plates. September, 1879. Bull. Mus. Comp. Zoöl., Vol. V. No. 15, p. 303.
VII. Contributions to a Knowledge of the Tubular Jelly-Fishes. By J. Walter Fewkes. pp. 20. 3 plates. March and April, 1880. Bull. Mus. Comp. Zoöl., Vol. VI. No. 7, p. 127.
VIII. On some Points in the Structure of the Embryonic Zoëa. By Walter Faxon. pp. 7. 2 double plates. October, 1880. Bull. Mus. Comp. Zoöl., Vol. VI. No. 10, p. 159.
IX. Studies of the Jelly-Fishes of Narragansett Bay. By J. Walter Fewkes. pp. 42. 10 plates (3 double). February, 1881. Bull. Mus. Comp. Zoöl., Vol. VIII. No. 8, p. 141.
X. On the Development of the Pluteus of Arbacia. By J. Walter Fewkes. pp. 10. 1 double plate. May, 1881. Mem. Peabody Acad. Sci., I. 6.
XI. On the Acalephæ of the East Coast of New England. By J. Walter Fewkes. pp. 19. 1 double plate. April, 1882. Bull. Mus. Comp. Zoöl., Vol. IX. No. 8, p. 291.
XII. On the Young Stages of some Osseous Fishes. III. By A. Agassiz. pp. 32. 20 plates. 1882. Proc. Amer. Acad., Vol. XVII. p. 271.

Alexander Agassiz.

Two pairs of appendages, known as the cephalic tentacles (*t*) and the cephalic setæ (*s*), arise from the head. Both of these cephalic appendages are embryonic.

The tentacles (*t*) are long, flexible bodies, which are sometimes closely coiled about their bases, and at other times widely extended. These appendages are transparent, of a slightly reddish color, and unjointed. Their surface is covered with short stiff spines or hairs, which are especially numerous near their distal extremities. Each appendage has a cavity throughout its length, opening into the body cavity, and through the walls the circulation of a fluid contained within can be easily seen. There are two of these cephalic tentacles, both of which arise from the dorsal region of the head, a little above the lateral lines of the body. They are probably homologous to dorsal cirri.

The cephalic setæ (*s*) are smooth, easily deciduous spines projecting from ear-like lappets on the dorsal side of the head below the cephalic tentacles. Their length varies, but in young specimens it is about one half that of the body. Although generally carried separated in a fan-like manner, they are often folded closely together, parallel with the sides of the body (Fig. 6). The cephalic setæ are probably homologous with the embryonic spines of (*Nerine*) *Spio*, and may be regarded as the setæ of a single segment of which the head is formed. It is a significant fact that these spines, as far as known, are only found in those annelid larvæ which are free swimming. In the young *Arenicola*, for instance, which passes its youth enveloped in a mass of slime, these embryonic spines never appear. This fact leads one to ask if they are not special organs for defence rather than ancestral features descended from fossil forms, which according to A. Agassiz they sometimes closely resemble. Their peculiar positions when a *Nerine* or *Prionospio* larva is alarmed leave no doubt of their defensive function.

The mouth is terminal and slightly ventral. The proboscis is short when retracted, not extending back of the posterior part of the head. It is protrusile even in this early condition, and bears a chætinous (?) toothed body of red color, visible through the mouth opening. The position of the posterior extremity of the proboscis is marked by a pair of diverticula (*g*) from the intestinal tract, whose walls are here pigmented with brown and yellow. They lie near the medial dorsal line, one on each side of the junction of proboscis and œsophagus. These "glands" begin to form as small lateral diverticula from the œsophagus, and extend forward in the body cavity, one on each side of the proboscis. Later in their growth yellow pigment appears in their walls, and they assume a superficial likeness to glands. In the dorsal medial line, upon the intestinal tract between them, there is a pulsatile sac opening into a large anterior vessel. The pulsatile sac resembles a heart; the vessel opening from it, an artery which may distribute blood to the head and cephalic tentacles. Of the true homology of these organs there is, however, some doubt.

The body of the youngest *Prionospio* (Fig. 1) is composed of nine anterior segments, bearing as many pairs of long provisional setæ and four smaller terminal segments without spines. Consequently, it will be seen that in the youngest larva two segmented regions can be distinguished in the body; the anterior (*a r*) forming its great mass and bearing provisional setæ, and the posterior (*p r*) relatively almost inconspicuous in size and without spines. The terminal segments of the latter are colored by bright red pigmentation. The diameter of the intestinal tract narrows uniformly from the head to the anal extremity, with little variation in different regions.

Marked changes of most important character have taken place in the head and body of the next oldest larva (Figs. 2, 3, 4, 5). The arrangement of the tentacles, setæ, and eye-spots on the head is about the same as in the former larva, and the dorsal walls have extended forward above the mouth into a lip which had a rounded border, forming a structure which persists into the adult, and will be called, in subsequent larvæ of this worm, the præoral lobe. This nomenclature, however, does not imply that it is homologous with the structure which has the same name in certain other Annelid larvæ. The body of this larva has dropped, either normally or abnormally, most of its embryonic setæ, and three regions, an anterior, a middle, and a posterior, have differentiated themselves in it. Almost the whole of the body is still taken up as formerly by the anterior region. The middle region (*m r*) is smaller than the anterior, has its walls more thickly pigmented, and retains the embryonic setæ even when the larva is kept in confinement for some time. This region is formed from the originally undivided posterior part of the former larva. The posterior body region is the smallest of the three, and is the same as the non-spinous part of the body of the youngest larva.

The anterior region of the body in the present larva is composed of nine segments, the lines of separation between each pair of which, however, are not well marked. The lateral spines of this part are short and small. The body walls are very transparent. On the sides of the body near the fourth pair of spines there is a cluster of reddish pigment spots (*m s*), which persist even into the oldest larvæ which have been taken (Fig. 13).

The middle body region, which is developed from the original posterior portion, is formed of four segments, the constrictions between which are deep and well marked. The segments are sometimes swollen to a diameter greater than that of the transparent anterior portion of the body. The walls are thicker than those of the transparent part described above, and are more densely pigmented with yellow and brown. That portion of the digestive tract which lies in the middle body division is here considered the stomach. The posterior division of the body has a smaller diameter than either of the others, and is without appendages. It is, however, segmented, and later in its growth becomes spiniferous. The terminal segments bear small papillæ, and are colored with crimson pigment.

The next following larvæ (Figs. 6, 7, 8, 9), which are slightly more mature than the last, differ from it in several particulars. The most important changes which have taken place in the form of the head (Fig. 9) are an antero-posterior lengthening of the whole segment of which it is formed, and a still greater projection of the præoral lobe, which also becomes more pointed. Perhaps the most significant of the general changes which have occurred is the appearance of a basal joint in the cephalic tentacles. These appendages, which in all the younger larvæ are almost uniform in size throughout, in this are found to be marked at a short distance (*b f*) from their origin with patches of red pigment. The color is first seen on the anterior wall of the appendage. The walls of the tentacle, where this pigment first appears, are somewhat thickened, and a slight corrugation forms on the tentacle at this point (Fig. 9).

The body of the larva has meanwhile become more elongated, and two additional bundles of setæ have arisen on each side in the anterior or transparent region of the body. The backward growth, leading to an increase in the distance between the "glands" (*g*) found at the posterior part of the head and the cephalic tentacles, has greatly increased, while the size of the "glands" has diminished. The portion of the intestinal tract which lies in the transparent anterior region of the body, between the glands mentioned above and the first of the four segments which compose the middle body region, fills most of the body cavity, and lies on the dorsal side. Each parapodium of the anterior body region is double, consisting of a dorsal and ventral protuberance, both bearing a small bundle of setæ. The parapodia of the middle and posterior regions have a single protuberance of similar character.

The general appearance of a larva a little older (Figs. 10, 11) than the last is somewhat different by reason of the loss of the temporary embryonic setæ (*s*) formerly found on the head. It is extremely difficult to indicate definitely the time when these bristles normally disappear, but it is probable that the disappearance takes place when the larva is in about the condition figured in Fig. 11. The internal modifications of structure which have taken place in passing into this larva are important. The diverticula ("glands," *g*) mentioned above have changed their position relatively to the crimson pigment spots (*m s*) of the fourth pair of bristles. They are now situated in the same segment as these spots, and a diameter connecting opposite clusters of setæ passes through them both. Important changes have also taken place in the cephalic appendages. The basal portion (*b t*) of the tentacle has enlarged at the expense of the distal, which is the remnant of the embryonic appendage. Fully one half of the old tentacle (*t*) now enters into the formation of the new basal joint, which ultimately becomes a permanent cephalic appendage. The distal end of the same is not changed from the condition which it formerly had. The corrugations of the anterior wall of the basal joint have risen into small appendages, which gradually increase in size as one compares those found near the head with those at the distal end of the joint near its articulation with the distal article. These appendages cease at the point of division between the basal and terminal joints. Patches of reddish pigment are found at intervals corresponding with the positions of the parapodia along the anterior region of the body. Although their color is less conspicuous on other segments than on the fourth, it is as a general thing best marked on the anterior somites. The protuberances ("auricles") from which the embryonic spines (*s*) of the head formerly arose, are also marked with crimson (Figs. 10, 11).

In this stage, the peculiar crochet spines (*c h*) hanging to the posterior region of the body first appear.* On each segment three pairs of these bodies were counted. They arise from the dorsal region of the parapodium. In addition to these appendages the posterior body segments also bear on a ventral elevation smooth spines similar to those on the anterior and middle regions of the body. Later, the hook-like setæ (Fig. 13, *b*) appear on the segments of the middle body region, and rudiments of them may exist in the middle division of the body of the larva we are considering.

The last segment of the posterior region of the body (Fig. 12, *a*) has an oval elongated shape, and is dark red in color. It is flattened ventro-dorsally, broadening into small lateral expansions. Minute papillæ are found on the terminal segment. The anterior body region is now formed of nine, the middle of five, and the posterior of ten segments. The oldest larva of *Prionospio* which was found (Fig. 13) was raised from the last, and differs from it in many particulars. The præoral lobe (*p l*) is much larger and more prominent than formerly. The cephalic tentacles have wholly absorbed the embryonic appendages, whose place they now occupy, appearing as two tentacular bodies with appendages (branchiæ ?) on their anterior outer walls. The tentacles found on the head in the youngest larva have been wholly absorbed into the proximal joint (*b t*). The separation between the middle and posterior divisions of the body is not as well marked in the oldest larva as in those which we have already considered. The posterior limits of the anterior division is easily recognized from its transparency. Although this portion is more transparent, its division into different segments is not as evident as in the middle region. It bears nine bundles of setæ, arranged at regular intervals on each side, and we may regard it as made up of nine segments.

Each parapodium consists of a dorsal and ventral prominence, upon each of which there is a small bundle of setæ. The cluster of crimson (*m s*) opposite the fourth bundle of spines is still well marked. The "glands," which in earlier larvæ were so prominent, have in this very much diminished in size, or completely disappeared.

The intestinal canal does not now occupy comparatively so large a part of the cavity as formerly, and its course is more tortuous, especially in the posterior region of the body, than in the preceding. Not only have the temporary cephalic bristles fallen off, but also the long spines found on the body have been replaced by shorter and less conspicuous setæ. The most persistent of these deciduous spines are situated in the middle region of the body. In this larva, however, these have given place to minute bristles, and to the "crochet hooks" (Fig. 13, *b*) of the terminal region. I am inclined to think that the temporary body bristles are confined to that portion of the body which is described above (Fig. 1, *a r*) as the anterior region.

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* These spines were first noticed in a larva of this age. They may have escaped observation in earlier larvæ. The embryonic spines of all Annelid larvæ easily fall off when kept in confinement, and there is no uniformity in the appearance of the larva when they disappear under these conditions.

The colors of the oldest larva (Fig. 13) are similar to those of the younger. The præoral lobe has little color except in the green regions near the eye-spots. There is in the cephalic dorsal walls, in front of each of the lateral eye-spots, a hemispherical green body. Just below and in advance of the median pair of eye-spots there is a body of the same kind, which has a median prolongation extending nearly to the anterior margin of the præoral lobe. The cephalic tentacles are reddish in color. The lateral lobes on the head, from which the spines formerly arose, are likewise red. The body of the worm is green and brown, with red pigment spots.*

The temporary cephalic tentacles are homologous with the dorsal cirri, while the temporary setæ are strictly the same as those found on the segments of the body.

It will later be seen, in a description of the young (*Nerine*) *Spio*, which likewise has embryonic spines on the head, that two long dorsal cephalic appendages or tentacles also exist in this genus. Here likewise these bodies may be regarded as homologous with dorsal cirri, and as belonging to the same segment as the embryonic cephalic spines, which are later dropped. The median and lateral antennæ and the palpi are not represented in *Prionospio*. From this absence of the appendages last mentioned, we are not to suppose that they indicate in *Lepidonotus* a larger number of cephalic segments than that which exists in *Prionospio*.

In the account given above, the two long appendages to the head are called tentacles, from the fact that in younger larvæ they resemble so closely the tentacles of other Annelides, especially those of the *Spionidæ*. In function, however, they are probably in later larvæ branchiæ, and ultimately assume a form approximating that of the branchiæ in other Annelides. In the growth of the worm, additional branchiæ must also be formed, if we are right in our reference of this larva to *Prionospio*. Intermediate larvæ between that last mentioned and the adult may show that a new identification must be made, and that the larvæ do not belong to *Prionospio*.

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* Professor Verrill has kindly examined some of my sketches of this worm, and writes me that they can perhaps be referred to the Annelid which he has mentioned in Amer. Jour., November, 1882, under the name of *Prionospio*. (See also Trans. Conn. Acad., Vol. IV., Pl. XXVII. Fig. 3.)

Spio sp.

Plate II.

The embryos of a species of *Spio* are among the most common larval worms found at Newport. They are very characteristic in form, and on that account are seldom confounded with the larvæ of other genera.

The youngest *Spio* (Fig. 3) is telotrochal, and has a large, præoral lobe bearing an equatorial ring of cilia and embryonic spines, which arise from ear-like backward projections of the head. There are no paired cephalic appendages, and no cephalic eye-spots, although scattered pigment marks the future position of the latter organs on the dorsal region of the head. The embryonic spines are about double the length of those on the body. Each embryonic spine, even when slightly magnified, is found to bear small lateral spurs at regular intervals along its length. When the larva is alarmed, the spines are raised, and project at all angles to their point of origin.

The body is unsegmented, and, like that of other telotrochal Annelid larvæ, bears at its posterior end a ring of vibratile cilia, which arise from a thickly pigmented caudal segment.

In a larva still older* (Fig. 1) than the last, several marked changes have occurred. One of the most important of these is a division of the body into somites, although no parapodia are yet visible along the lateral lines. When seen from the dorsal side, the ridge which bears the ring of cilia will be observed standing out more prominently from the body than in early conditions. Along the anterior or upper part of this ridge there is a row of pigment spots. Slightly removed from the median line, and a little in advance of the ciliated ridge last mentioned, there are four eye-spots, called lateral ocelli. An additional pair of median eye-spots is placed near together on a slight backward extension of the head, behind the ciliated ridge. These, apparently, are wanting in a similar larva of *Nerine*,† of about the same age.

The cephalic appendages (Fig. 2) are short and blunt, and have a length of about one third that of the body. They correspond to the dorsal cirri of the segment which forms the head. Small ventral cirri of the same segment are also found on the same side of the head as the mouth. The body consists of five segments and a terminal joint, which bears a well-marked circle of anal cilia. Each intermediate body segment is pigmented in the following pattern. When seen from the dorsal side, five narrow parallel bands of black pigment extend across the body in the interval between a line on the body opposite the extremity of the dorsal cephalic cirri and the anal circle of cilia. Each of these lines corresponds to a body segment, and, extending through about one

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* This larva is of about the same age as that figured and described by Leuckart and Pagenstecher in Müller's Archiv for 1858, Taf. XXIII.

† See A. Agassiz, On the Young Stages of a Few Annelids, Ann. Lyc. Nat. Hist., Vol. VIII., 1866.

fourth the circumference of the body, lies midway between anterior and posterior border. Five similar lateral lines of black pigment alternating with those of the dorsal region are found on the sides of the larva. These markings are placed in two lines, and are found on each segment, but do not join the dorsal series of markings, since they are placed in different regions of the body segments, which are not continuous. On the ventral side of the larva, similar lines of black pigment also appear; but, instead of extending across the medial line, as the markings on the back, they are arranged in two series of parallel markings, of which there is a row on either side of the median line.

The number of segments in the next oldest larva has increased to seven, or, if we include the terminal, to eight. The pattern of color in each segment is the same as that in the younger larva already described. In this, the number of pigment spots on the head has also increased. At the base of the cephalic appendages, near their origin under the ciliated ridge, more especially in the ear-like protuberances ("auricles") which carry the embryonic setæ, there will also be noticed prominent patches of crimson pigment.

Spines indicating the position of future parapodia have appeared in the body segments, although the lateral protuberances are still quite small. The spines of the penultimate segments in many specimens are much longer than the others. The intestinal tract, with the exception of the bend which the œsophagus makes just before it opens into the stomach, follows an almost direct course from the mouth to the vent. The lips and walls of the œsophagus are richly ciliated. The external walls of the body are sparsely covered with small black pigment dots.

Aricidea sp. (?).

Plates II. and VI.

A series of larval Annelides referred to the genus *Spio* has been described by Claparède and Metschnikoff.* The youngest larva, which is here considered the young of *Aricidea*,† closely resembles the oldest which they describe.

The youngest larva of this genus has a close likeness to the young *Spio* (p. 173), but differs from it in having three pairs of setæ, one upon the head, a second on the body at about two thirds the distance from the mouth to the posterior end of the body, and a third at or near the posterior terminal segment. In very young larvæ these spines are very short. The head is more rounded than that of *Spio*, but like it has two ear-like lappets from which the temporary bristles below the ring of cilia arise. There are no eye-spots, and instead of well-bounded ocelli irregular patches of pigment are found on the dorsal surface of the head in a position where eye-spots are later to be seen.

The temporary head bristles are smooth, and destitute of the lateral spurs

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* Zeit. Wiss. Zool., XIX., 1869.

† *Aricidea* Webster is not found in our waters. It was taken by H. E. Webster on the Virginian coast. Trans. Albany Inst., Vol. IX., 1879.

already spoken of in *Spio*. There is no well-defined ciliated cephalic ridge bounding the præoral lobe. The body is divided into two segments by a deep constriction just in advance of the first of the two bands of body cilia. The segment which forms the anterior portion of the body shows a number of annulations; the posterior part of the body is thickly pigmented in irregular patches. The final segment bears laterally a pair of long setæ, which extend backward beyond the posterior end of the body. The anterior body segment seems destitute of lateral spines. Bands of black pigment mark the position of the two circles of cilia which accompany the body segments.

In the next oldest larva, raised from the last, we find that the body has become more elongated, and is now marked with two deep constrictions forming three body segments. The anterior of these is crossed by a number of lines forming the annulations to which reference has already been made. The second bears a pair of lateral setæ and a band of pigment. The third body segment carries two ciliated rings, each encircled with bands of pigment. That portion of the head which is in advance of the irregular patches of pigment already mentioned bears a small band of cilia.

An older larva has a body even more elongated than those already described, which is divided into four segments, the first and second of which bear lateral spines. Two pairs of ocelli have differentiated themselves from the irregular masses of pigment formerly found in the dorsal walls of the head.

The next oldest larva was not raised from the last, but has so many resemblances to it that it seems identical with the larvæ already described.

The head has the same general form as that of the preceding, although the præoral lobe is less prominent. It has four eye-spots. The body is divided into fifteen segments, each with lateral spines, and a single terminal segment which is destitute of these bodies although richly ciliated. The spines of the anterior segments are much longer than those of the following. Almost the whole interior of the body is occupied by a stomach, which narrows abruptly in the twelfth segment, passing into a tubular uncoiled intestine. The head of a larva (Pl. VI. Fig. 10) following the last in age is different from that of its predecessor, in possessing a single median antenna (*m t*). The body of the same has fifteen segments, and still retains the embryonic setæ, although their length has very much diminished. The head bears four eye-spots. The cephalic auricles as well as the terminal body segment are still richly ciliated. The stomach ends in the neighborhood of the tenth body segment. The intestine is narrow and straight.

The loss of the embryonic setæ of the head occurs at about this age in the growth of the worm, and in a larva of about the same age as the last, having still fifteen body segments and a ciliated caudal one, these long spines have fallen off, leaving the cephalic "auricles" projecting prominently outward back of the head and in advance of the anterior body segment. This is the oldest larva of the series which was taken.

The above history of the larvæ which are referred to *Aricidea* is of interest on account of the fact that the worm has in the oldest larvæ the long provisional setæ, yet wants the other cephalic appendages of the larval *Spio*. In other words, the appendages, which have been homologized with the dorsal cirri of a head segment, are never developed in this genus, while the spines are formed only to disappear in subsequent growth of the worm as it matures. The median antenna and other cephalic appendages are subsequent growths, and may be looked upon as appendages of the originally single segment.

Polytrochal Larva.

Plate VI.

A single polytrochal larva was taken about the end of the summer. The body is elongated, wormlike, and bears on the sides of the head two flat circular ear-like appendages ("auricles"). Two small well-marked median cephalic eye-spots are well developed. There are no tentacles, palpi, nor tentacular cirri. The rudiments of two appendages resembling tentacles yet of a circular shape point to a relationship between this larva and some member of the *Spionidæ*. The body is composed of twenty-four segments. The posterior terminal body segment ends in two protuberances. Each of the body segments is pigmented on its posterior border. Along the dorsal region of the larva there is also on the median line a similar although larger mass of pigment. There are ten small pigment spots, ring-shaped and of black color, which are placed at regular distances on one side of the body. Each lies on a ciliated segment, and is situated in a median line on the ventral side of the larva.

The pigmental rings (*p r*) on the ventral side of the body of the above-described polytrochal larva seem to have a morphological meaning. At the same time with our collecting of *Spio* larvæ we captured many young worms (Figs. 2, 3, 4), which in outward appearance resemble very closely the older stages in the growth of the same. These larvæ, however, have one very interesting difference, which allies them more intimately with the polytrochal larva described above. As in many Annelid genera, *Phyllodoce*, *Prionospio*, *Telepsavus*, and others, the fourth body segment is modified by the introduction of different-shaped spines, or by pigmentation of the body walls, we naturally expect in other genera to find this segment individualized as compared with its neighbors. In a worm larva, somewhat resembling the polytrochal just described, we find on the ventral side of the fourth body segment a pair of pigmented eye-spots (ocelli ?), and that the fourth body segment bears a belt of large cilia similar to those found on the head and caudal extremity. While we recognize in these pigment spots the homologue of the ring-shaped pigmented regions in the median ventral line of the polytrochal larva, we can see in this larva an intermediate larval form between the telotrochal and polytrochal conditions. The pigment spots are probably homologous with the pigmented regions (*m s*) already described in *Prionospio*, where, however, they are forced more laterally, and the ciliated ring on the same segment is lost.

Telepsavus (?).

Plates III. and VIII.

The most common mesotrochal larva at Newport is similar to one supposed by Claparède and Metschnikoff* to be the young of *Telepsavus*. The adult *Telepsavus* has not been found in Narragansett Bay, and the allied genus *Spiochætopterus*, to which Dr. E. B. Wilson † doubtfully refers larvæ from the Chesapeake Bay with many points of resemblance to those which are about to be described, has also not yet been recorded from the locality where my studies were made.

A very common worm larva, which has the whole surface ciliated and an apical compound flagellum, but in which no equatorial ring of cilia had formed, is very commonly found at Newport in our dip-nets. These larvæ (Pl. VIII. Figs. 12, 13, 14) resemble closely the young of *Chætopterus*, but are larger, and in older stages more elongated. They resemble closely the young *Telepsavus* figured by Claparède and Metschnikoff, and on that account are here referred to this genus, although they have not been raised into any member of the present series. They might equally well, however, be connected with the larvæ which have been identified as belonging to the closely allied genus *Phyllochætopterus*.

The young *Telepsavus* (Pl. III. Figs. 6, 7) is quite large as compared with other Annelid larvæ, and can with the unaided eye be easily distinguished swimming about in the water. The body is swollen into an almost globular shape, and is divided into two regions by a mesial ring of cilia. In the youngest stages of growth neither of these divisions is segmented. A fleshy triangular lobe, rounded in front, is largely developed, and extends beyond the mouth on the dorsal side of the head. The lower lip is bilobed. There are two cephalic eye-spots in the youngest larva. The whole body is covered with cilia, and a prominent median cilium is found on the præoral lobe near its rim. The mouth (*m*) has a triangular shape, opening below the lobe, and is surrounded by fleshy lips. No tentacles or cephalic appendages are yet developed.

The posterior portion of the body is short, tapering to the posterior pole of the larva, which bears a segmented (?) tail (Fig. 7, *a*). The anus is dorsal in larvæ of this age.

Almost the whole interior of both cephalic and caudal regions of the body is taken up by a large cavity (*s*) called a stomach, which occupies the greater part of the anterior body region, and extends a short distance into the posterior part. Its walls have a green color, while those of the body are brown and pink. A diverticulum from the stomach extends forward in the ventral region of the body cavity below the œsophagus. The œsophagus in its course bends twice upon itself, and opens into the stomach on the dorsal side. Its walls are thicker than those of the stomach. The intestine is short, slightly coiled, and opens externally through a dorsal anus. The "ventral gland" (*v g*), indicated by a depression in the external body wall on the ventral side of the anterior body region, has not yet appeared.

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* Zeit. Wiss. Zool., XIX., 1869.

† Observations on the Early Developmental Stages of some Polychætous Annelides, Stud. f. Biol. Lab. Johns Hopkins Univ., Vol. II. No. 2.

The above larva is easily distinguished from the young *Phyllochætopterus* (Fig. 16) of about the same age, by the absence of dorsal median eye-spots near the long cilium on the præoral lobe of the head.

In the next oldest larva (Fig. 5) of *Telepsavus*, we find that a new pair of lateral eye-spots has formed, and two slight projections, one on each side, at the base of the head, now appear. These last-formed bodies are the beginnings of cephalic appendages, which later attain a great development. In other particulars, the two larvæ differ very slightly from each other.

The next oldest larva (Figs. 8, 9) to that last described is one in which we have few changes, except those which result from the growth of the cephalic tentacles. Segmentation of the body has begun in the posterior hemisphere, but it has not yet appeared in the anterior. The present larva is almost identical with one of those figured by Claparède and Metschnikoff.*

A larva somewhat older (Figs. 10, 12) than that last mentioned shows more striking resemblances to other Annelid larvæ than any of those which have been spoken of above. Anterior and posterior portions share about equally in the elongation of the whole body. Very slight changes have taken place in the head, although the præoral lobe has elongated and become more prominent, and the median cilium has fallen off.

On the ventral side of the body, a deep infolding ("ventral gland," *v g*) of the body wall has taken place, at a point about one third the distance from the ciliated belt to the front edge of the lower lip. Eight simple lateral protuberances, each bearing a small cluster of spines, are found in the interval between the cephalic appendages and the ring of cilia. On the fourth of these parapodia, counting from the anterior, there are spines (*m s*) which can be homologized with the cluster of spines on the fifth segment of *Polydora*.† These bodies occupy in *Telepsavus* nearly the same position as the crimson pigment spots (*m s*) near the "fourth segment" in *Prionospio*. The portion of the body behind the equatorial ciliated circle has become segmented. The segmentation constrictions are clearly defined, especially on the ventral side of the body. Two pairs of lateral branchiæ (*b*) appear on the segment just behind the ring of cilia, and a single pair on the following.‡ These appendages are richly ciliated over their whole surface. The œsophagus (*œ*) extends through the anterior part of the body cavity from the mouth to the seventh segment of the

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* *Op. cit.*

† In *Polydora*, according to A. Agassiz, these spines are found on the fifth segment, which is really the fourth body segment if we regard the head as a single somite. The clusters of red pigment in *Prionospio* are also found on the fourth body segment.

‡ In Dr. Wilson's larva "two pairs of branchiæ" appear "on each of the two segments behind the thickened ciliated ring."

anterior body region. The stomach (*s*) fills most of the body cavity from that point to the sixth segment of the posterior region. The intestine (*i*) is coiled in the posterior part of the body cavity behind the stomach. The anus, as before, opens dorsally. The "tail," a median terminal appendage, is segmented and slightly enlarged at the distal end into a knob or button.

The oldest larva (Fig. 11) gives no more definite information than others already known in regard to the genus to which it belongs.* The posterior part of the body of this larva is swollen, leaving the band of cilia about midway in its length. The præoral lobe has become more contracted, and the external surface of the body is covered with small papillæ. Another pair of pigment spots — the cephalic eye-spots — has been added to the two already existing. The cephalic appendages have elongated so that their tips extend downward to the vicinity of the ring of cilia. There are now ten parapodia in the anterior region of the body between the cephalic appendages and the band of cilia.

The posterior portion of the body is almost hemispherical. The median anal appendage is greatly reduced in size, appearing as a slight projection, on either side of which there are similar lateral knobs. The intestine is slightly coiled, and lies wholly in the posterior body cavity.

Phyllochætopterus sp.

Plate III.

The youngest larva (Figs. 16, 17), of this genus which we have obtained resembles closely a young *Telepsavus*. It is mesotrochal, and has a large præoral lobe, which, like that of the older form of the same figured by Claparède and Metschnikoff,† bears six eye-spots upon the dorsal region. These eye-spots consist of a pair of median and two lateral ocelli on each side. The oral lobe carries on its rim, just in advance of the median pair of ocelli, a flagellum, as in *Telepsavus*. The young *Telepsavus* has four eye-spots; the median pair failing even in a larva in which the tentacles have begun to form on the sides of the head. The youngest *Phyllochætopterus*, even when it has developed into a larva possessing six eye-spots, is still destitute of lateral cephalic tentacles.‡

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* Professor Verrill (Trans. Conn. Acad., Vol. IV., Pl. XVIII. Figs. 16, 17) figures this larva, and in MS. explanation of plates, which he has kindly sent me, refers it doubtfully to *Spiochætopterus*. His larva is a little younger than that which is here figured in Fig. 19.

† *Op. cit.*

‡ The Annelid larva (*Mesotrocha sexoculata*) described by Johannes Müller (Müller's Archiv, 1846), by Busch (Ibid., 1847), and by Max Müller (Ibid., 1855), seems more closely allied to this than to the preceding (*Telepsavus larva*). Like the *Phyllochætopterus larva*, it has six eye-spots and two mesial rings of cilia separated by a wide segment. In the figures, however, which are given by the above-mentioned authors, there is no representation of a tuft of cilia (flagellum) situated on the præoral lobe between two of these eye-spots, as is mentioned in the larvæ of

The body of the youngest *Phyllochætopterus* is divided into a large thick anterior, and a smaller posterior region. The mouth opens as a triangular slit on the ventral side, near the anterior extremity of the former. The posterior extremity of the posterior region of the body bears a short median appendage. The mesial band of cilia thus separates the body of the larva into two regions. The anterior of these, which lies in advance when the Annelid is in motion, has a slight depression in its ventral region which marks the position of the "glandular body" described in the larva of *Telepsavus* (and *Spiochætopterus*). The œsophagus, stomach, and intestine can easily be seen through the walls of the body. The anus opens on the dorsal side of the posterior body region, just in advance of the medial caudal appendage. A still older larva (Fig. 18) shows one in which two rows of cilia, separated from each other by a broad segment, are well developed. A segmentation of that part of the posterior body region which is behind the smaller ring of cilia, as well as the more elongated form of the whole larva, is to be noticed in this worm. No cephalic tentacles have yet formed, and the external surface of the body is still covered with small cilia. The globular appendage to the posterior region of the body, figured by Claparède and Metschnikoff,* was not observed. The discovery of the youngest ot these two larvæ of *Phyllochætopterus* is interesting, as showing how close the resemblance between the youngest known *Phyllochætopterus* † and the so-called *Telepsavus* larva is; or, that the young *Phyllochætopterus* larva has but one ring of cilia between the anterior and posterior openings of the digestive canal, as other mesotrochal larvæ. The second and smaller ring is a later addition.

Nephthys sp.

Plate IV.

The very little which is known of the development of *Nephthys* we owe for the most part to Claparède and Metschnikoff.‡ Larvæ similar to those which they describe, yet in different stages of growth, were raised or fished up in great numbers in our work.

The youngest of these (Fig. 1) are telotrochal, and may be classed with the larva of *Polygordius*. The præoral lobe is very large, and imparts an almost spherical shape to the upper hemisphere of the larva. Equatorially about the larva there runs a ridge upon which a circle of large and powerful cilia is borne. The upper hemisphere or præoral lobe is rounded; the lower more pointed. The whole larva has a green color, is somewhat transparent, and is

both *Telepsavus* and *Phyllochætopterus*, by Claparède and Metschnikoff, and in the present paper.

* *Op. cit.*

† The adult *Phyllochætopterus* has not been recorded in our waters. (See Verrill's Check List.) Chaparède and Metschnikoff's identification of the larva has been followed in my studies.

‡ *Op. cit.*

ciliated on its outer walls. The ridge upon which the large cilia arise is colored light red. At the lower pole near the vent there is a ring of small cilia. No segmentation has yet appeared in the lower hemisphere. There are conspicuous pigment spots in the lateral walls of the præoral lobe, but they appear in irregular patches of red and brown color. The general disposition of the internal organs is easily seen through the transparent body walls. By far the greater part of the interior of the larva is taken up by the stomach (*s*), a globular inflated sac with gall-green colored walls. It occupies most of the interior of the oral lobe of the larva above and in advance of the ciliated equator. The digestive tract communicates with the external water through two orifices. The first of these is a mouth, and the vestibule intermediate between it and the stomach is probably the œsophagus. The mouth opening lies on one side (ventral) of the larva, just below its ciliated equator. The lower lip of the mouth is richly ciliated. The double row of cilia which together make up the prominent mesial ring divides in the vicinity of the oral opening, one half, composed of smaller cilia, passing below the mouth on the lower lip; the other, or larger, skirting the border of the upper lip. The inner walls of the œsophagus and stomach are likewise ciliated. The lower pole of the larva is placed at an unequal distance from the equator measured on ventral and dorsal sides of the body. Almost the whole of the lower part of the cavity of the embryo, below the plane of the equatorial band of cilia, is taken up by the intestine, which is an elongated sac-like body opening into the stomach on one side, and into the external water through the vent on the other.

The pattern (Fig. 1, *a*) of color on the anal pole of the larva is characteristic in *Nephthys*, and on that account has been of great service in identifications of larvæ of different ages, whenever one could not be raised from another. The pigment is here arranged as follows. Two small areas of green color are found on either side of the anal pole. These areas coalesce with each other on the dorsal, and are distinct on the ventral side. Slightly in advance, and removed from them by a colorless zone, there is a narrow parallel band of green, closed on the dorsal, and open on its ventral side, encircling the body. This unclosed band marks the position of an anal ring of vibratile cilia. It persists with the same characteristic form in very late stages in the development of the worm.

The next oldest larva (Fig. 2) to that described has assumed a slightly different form from the last. The body is no longer spheroidal, but the lower hemisphere has elongated to double its original length. In this growth the præoral lobe has taken, comparatively speaking, no share, and still remains of about the same shape as before. A zone of green appears about the pole of the præoral lobe, and most of the scattered cilia on the external surface of the body have disappeared. The lower or body hemisphere, on the other hand, has become elongated and segmented, although no parapodia have yet appeared in the several body segments. The intestine has lengthened considerably. Its walls, as well as those of the stomach, have a green color, as in younger larvæ.

In a larva still older (Fig. 4) the growth of the body hemisphere has gone on, and new segments have been interposed between the ciliated ridge and the anal pole. A pair of pigment spots (*k*) resembling ocelli, or "eye-dots," appear in the dorsal walls of the præoral lobe. The general appearance of this larva from the ventral side is characteristic. The præoral lobe is no longer hemispherical, but the elevation of the pole and the formation of a circular ridge or zone a short distance above the ciliated equator imparts to it a characteristic shape. The rounded projection or polar elevation of the præoral lobe above this zone is crowned by a cluster or tuft of cilia. A black spot is found on each side of a median dorsal line passing to the apex of this protuberance. The green zone which was formed in the cephalic region of Fig. 2, while the præoral lobe had a regular hemispherical shape, has now increased in width, and the wall in which it lies bulges out, forming a collar about the lobe. This collar has a more greenish color than the rest of the larva. About its lower rim, however, there is considerable black and some red pigment. The mouth lies near the equator, situated similarly to that of the young *Polygordius* ("Loven's larva"), between two rows of cilia.

The most important change which results in passing from that represented in Fig. 4 into the next oldest *Nephthys* (Fig. 5) is a still further elongation of the body, and consequent diminution in size of the præoral lobe. The most important addition is the formation of the parapodia, the spines (Fig. 6, *b*) of which even in this early stage are serrated, like those of the known species of *Nephthys*. The number of body segments is nine. Each parapodium (Fig. 12, *b*) has a dorsal and ventral cirrus, and bears two bundles of setæ, each composed of several short, serrated spines. The form of the stomach and intestine is more elongated than in the earlier larvæ.

A larva a little older (Fig. 6) than that last described, although not unlike it in general contour, differs considerably from it in some particulars. This difference is a result of changes which have taken place in the internal organs. On looking at the larva from the ventral side, the mouth can be seen just below the equatorial ring of cilia. Behind the mouth through the body walls appears the œsophagus, which when seen from the ventral side has a circular profile. Below the mouth, extending to the region of the seventh body segment, is the stomach. At this point (seventh segment) the intestine begins, and from it is continued into the terminal body segment. Just below the junction of the œsophagus and stomach, on the right-hand side of the figure representing a larva of this age seen from the ventral side, there will be noticed an indentation in the stomach walls, forming by the enlargement a space in the body cavity, in which lies a globular sac. The pulsations of the sac in this and subsequent larvæ can be plainly seen through the body walls. The terminal body segment ends bluntly in two lateral prominences, which are colored green. In the median line between them on the dorsal side there is a small unpaired appendage, which persists in subsequent stages into the oldest larva of *Nephthys* which was studied.

Fig. 7 represents a larva of *Nephthys* still older than the last. The whole larva, more especially the body region below the circle of cilia, has become longer, and additional segments have formed in the body, by which a still greater likeness to the adult worm has been acquired. It is still, however, free-swimming, although sometimes resting upon the bottom of the glass in which it is confined. The penultimate as well as the terminal body segments, are destitute of spines. The œsophagus has lengthened considerably, and through its walls the jaws (*j*) can be easily seen between the third and fourth segments.* The stomach walls are opaque and colored green.

The "pigment dots" (*k*) found on the apex of the præoral lobe have now changed their position in the head, and moved somewhat backward towards the middle of the body. Each lies on the outside border of a transparent body of spherical shape, which touches on the median line of the larva a similar body on the opposite side. Both are situated in the dorsal walls, and are almost invisible when the larva is viewed from the ventral side. The rows of cilia about the neck are very active, as are also those near the posterior end of the body. The head retains its comparatively large size, and is without appendages.

The next stage (Fig. 9) in the development of *Nephthys* shows us one where the reduction in the relative size of the head and body has gone on, and the cilia, which once formed such a prominent feature about the lower part of the former, have almost wholly disappeared. The head bears a single pair of short antennæ. The body is composed of ten setiferous parapodia and a pair of terminal somites, which are without spines. The segments are separated by deep constrictions, and each parapodium is composed of a ventral and dorsal protuberance, both of which bear serrated spines. The ventral cirrus is short and blunt; the dorsal long and slender.

The œsophagus has elongated to such an extent that its posterior end now extends backward in the body cavity to the eighth segment. The "eye-spots" (*k*) lie in the dorsal walls of the third body segment. When the œsophagus is protruded outside the mouth opening, these bodies retain their relative position as regards the segment, and are not moved with it, which indicates that they are not connected with the digestive tract, as might at first be supposed. The mandibles, with which they might be confounded, lie between the sixth and seventh segments, and can be protruded with the proboscis.

The oldest larval *Nephthys* (Figs. 11, 12) which was observed has ten body segments which bear spines. I was able in one specimen to detect on the head the beginning of a single representative of a second pair of antennæ, although such could be seen only on one side. In this larva, which is shown in Fig. 11, the head is quite small as compared with the body. The distance from the tip of one lateral spine on a body segment to the end of another, on the opposite side of the body, is three or four times the breadth of the middle of the body. The dorsal region of the head has a green color, in which are irregular patches of black and red. The black pigment probably later concentrates into those

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* In the oldest *Nephthys*, figured by Claparède and Metschnikoff, they lie opposite the first body segment.

special pigment spots of the head which are called ocelli. The original "pigment dots" (*k*) lie in the third body segment. The point of separation between the stomach and œsophagus is near the seventh and eighth body segments. The formerly enclosed anal ring of green color and the two regions of green pigment on the last body segment have coalesced, so that the whole terminal segment has the same yellow and green color as the head. The intestine is slightly tortuous in its course, and is clearly differentiated from the stomach. Scattered red pigment spots appear on the external body walls along the dorsal and ventral median lines.

The oldest worm in the series described above was raised from the youngest through the successive stages mentioned. Although the larvæ as a rule bear confinement with little discomfort, I was never able to raise them into the adult *Nephthys.*

The identification of the larvæ of a related species by Claparède and Metschnikoff has been followed, since three forms of the larvæ which are here figured will be found to resemble "stages" which they have already represented. The oldest larva which was studied is much more developed than the oldest which they had, and approaches the adult form more closely, which seems to me to add new evidence to confirm the identification which they made. Until, however, it is raised into an adult, or the youngest is traced back to the mother through the egg, the identification must be regarded as provisional. The homology of the black spots originally found on the apex of the præoral lobe, but now in the fourth body segment, is doubtful. The theory that they are homologous with the embryonic otoliths of *Terebella,* has little to recommend it. It is not known whether they are lost in later growth in older larvæ or not.

Claparède and Metschnikoff speak of these "eye-spots" as eyes with lenses, and the neighboring transparent "cells" as brain lobes. In the oldest larva which they represent in their figures (Pl. XIV. Fig. 3, *c*) these bodies are situated in the head. In the oldest larva which is described in the present paper, they lie in the fourth body segment. Similar bodies have been figured by Bobretsky * in the larvæ of *Pholoë.*

The movement of the "eye-spots" from the head into the fourth body segment is probably brought about by the growth forward of the head and the anterior body segments. The means by which this has been accomplished is not, however, perfectly clear.

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* КЪ ИСТОРІИ РАЗВИТІЯ АННЕЛИДЪ, Pl. IX. Figs. 3, 4. The copy of this paper which I have used is from Zapiski Kiefskavo Obshto Yestestvoispitatalyei.

Lepidonotus squamatus (?).

Plates III. and IV.

The youngest* larva (Pl. IV. Fig. 14) of this genus is monotrochal. The body has a globular shape, upon which the arrangement of the circle of cilia is not perfectly equatorial. The pole of the cephalic hemisphere is pointed, and bears two eye-spots connected over the dorsal surface of the præoral lobe by a double row of pigment spots. Parallel with the mesial circle or circles of cilia are two rows of pigment spots on the upper and two on the lower (posterior) hemisphere of the body. The lower half of the embryo is more elongated than the upper. The mouth is widely open, and lies just below the rim which bears the larger cilia. The lower lip is fringed with a row of smaller cilia. The interior of the larva is occupied by a stomach, œsophagus, and intestine, which are not clearly differentiated from each other.

The next oldest larva (Figs. 16, 17), *Lepidonotus*, is characteristic.† The body has elongated itself, although it has not yet become worm-like in shape. The oral lobe is hemispherical, without appendages, and bears scattered cilia upon the pole. There are four eye-spots arranged in two pairs. The body bears three pairs of lateral appendages, and the terminal segment is prolonged into two short protuberances. When seen from below, each of these will be found to consist of a single appendage, from which arises a bundle of spines. Each of these spines ends in a small tooth and a short terminal articulation (Fig. 16, *a*). Upon the back of the larva we find rudiments of the elytra as diminutive circular plates hanging from the bases of the parapodia, which, however, do not cover these bodies. The interior of the larva is taken up by an œsophagus, a large stomach, which fills most of the præoral lobe and extends downward in the body cavity to the second appendage (parapodium), and a long, straight, narrow intestine, which diminishes gradually in size from its union with the stomach to the vent. Cephalic appendages first appear in a larva a little older than the last. (Pl. III. Figs. 1, 2.) The first of these to arise is the median antenna, which first appears as a stout median protuberance of the cephalic walls on the dorsal side of the head between the eye-spots. The larva now has six ocelli, three on each side. The two lateral antennæ form at about the same time, and have at first very much the same general appearance as the single median appendage.

In the oldest larva (Figs. 3, 4) which I have studied all the cephalic appendages have grown more prominent, while the head itself has become considerably reduced in size. In addition to the median and lateral antennæ, two palpi and two pairs of tentacular cirri have also formed. The anal cirri have greatly increased in length, and now resemble simple filaments.

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* The larval stages of *Lepidonotus* given above confirm closely in essential points the account of the metamorphosis of *Polynoë* contained in Max Müller's account published in Müller's Archiv for 1851. The segmentation and early development of the egg up to the formation of the monotrochal larva of an Annelid closely allied to Max Müller's *Polynoë* are figured by Sars (Wieg. Arch. 1845).

† This larva was not raised from the former.

When such a larva is seen from the dorsal side (Fig. 4), four large circular elytra can be observed above the parapodia. The setæ of the lateral appendages of the body terminate in a short joint, as in the youngest larva, which has already been described. Rudiments of a fifth pair of elytra, the next to appear, can be seen just behind the most posterior of those already formed, or between it and the posterior body segment.

The body of the larva is only partially transparent, although an intestinal tract is visible from the dorsal side through the elytra and dorsal body walls. The parapodia are well developed, and eight in number on each side of the body. Each parapodium is single, undivided, and bears a cluster of long bristles and a long dorsal cirrus. Each seta has a terminal joint and a basal articulation, which carries a small tooth, as in the younger larvæ which have been mentioned above. The elytra are still of diminutive size, although they cover the bases of the parapodia. The point of separation between the stomach and the œsophagus lies just behind and beneath the first pair of elytra. The stomach sends off lateral extensions in pairs corresponding to the second, third, and fourth parapodia.*

Larva of Nereis sp. (?).

Plate VI.

The young of a doubtful species of *Nereis* bears upon the head two lateral tentacles, and two short palpi, each with a basal and terminal joint, the latter of which is richly ciliated. There are also upon the head three well-developed tentacular cirri. The dorsal surface of the head has six eye-spots, two of which are placed near the anterior dorsal rim, and four near the posterior. All are widely separated from a median line.

The body is composed of ten segments, nine of which bear pairs of setæ. The parapodia are very prominent.† Each parapodium has a dorsal and ven-

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* The young of an unknown Annelid (Pl. IV. Figs. 13, 13^a) is easily mistaken for the youngest *Lepidonotus* mentioned above. Although monotrochal it wants the paralleled rows of black pigment spots situated above (anteriorly to) and below (posteriorly to) the mesial row of cilia. This embryo is exceptional among monotrochal larvæ, in possessing a single caudal appendage, which is well developed before lateral caudal cirri appear. The unpaired median appendage is not unlike that found in the mesotrochal larvæ of *Chætopterus*, *Telepsavus*, and *Phyllochætopterus*. Does this larva belong to the genus *Harmothoë*, or is it the young of some Bryozoan?

† Compare this larva, as well as the young *Nephthys* (Pl. IV. Fig. 12), in this particular, with the strange genus *Tetraglene* Verr. In respect to its color, size, cephalic appendages, and other particulars, the two are very different. Many specimens of *Tetraglene* have been taken in our work at Newport. (See Verrill, Trans. Conn. Acad., Vol. IV., Pl. XXV. Fig. 10.)

An unknown pelagic worm (Pl. VI. Fig. 5) was found on several excursions, tral cirrus. The final segment is destitute of lateral spines and has two long anal cirri.

The mandibles can be easily seen through the body walls, and are well developed in this early condition of the worm. The stomach extends from the second to the third or fourth body segment, and the intestine is a small straight tube. The body is transparent, colorless, or of a slight green or brownish tinge.

Pilidium recurvatum sp. nov.*

Plate V.

One of the most interesting of the worm larvæ found at Newport is a *Pilidium* which has many structural relationships to *Tornaria*, the larva of *Balanoglossus*, and to *Actinotrocha*, the young of *Phronis*. This *Pilidium* is the nurse of a worm which has many resemblances to the Nemertean genus *Lineus*. As it differs widely from any known species of *Pilidium*, I have given it for convenience in description the provisional name of *P. recurvatum* on account of the characteristic curvature at its upper end. The new *Pilidium* from Newport differs very greatly from any known species of this genus. The upper hemisphere of the larva is not greatly unlike that of the other species of the genus *Pilidium*, but the outlines of the lower hemisphere are so very exceptional that it is almost impossible to homologize it with any known forms. *P. recurvatum* has not the two circular lappets of *P. gyrans*, nor the arm-like bodies of *P. brachiatum* and *P. auriculatum*. The ring of cilia about the lower hemisphere of *P. recurvatum* is not represented in any other species of *Pilidium*, unless we homologize it with a part of the ring of large cilia on the rim of the body and along the edges of the circular oral plates of *P. gyrans*.

The youngest form of *P. recurvatum* which was taken is represented in Plate V. Fig. 1. The body is elongated, egg-shaped, with the upper end recurved and the mouth downward. The walls are of glass-clear transparency,

but always in the same condition, so that it is impossible to tell its age, although it seems to be immature. This worm is of very dark brown or black color, especially in the anterior body segments. The head is small and of spherical shape, although totally destitute of appendages. The eyes are large rounded bodies, two in number, deeply sunken into the anterior dorsal cephalic walls. They have a brownish or chocolate color.

The first six (?) anterior body segments have a black color, and bear small permanent setæ. The following segments of the body are furnished with very long spines, which are very conspicuous as the worm swims in the water. The posterior body segments resemble the anterior in bearing very short spines, although their color is lighter brown and contains more yellow than those of the middle body region. There are in all over fifty body segments. One or two specimens of this worm are taken each year, generally by night fishing.

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* This nomenclature is provisional. The larva is not a true *Pilidium*.

and their outer surface is ciliated. The lower hemisphere at a short distance from the lower pole is girt about by a ring of large cilia, which by their constant movement impart onward and various rotary motions to the embryo. It sometimes moves forward in the line of its length, and then whirls on its axis without any direct forward motion. Both of these movements are the results of ciliary action. From the thin outer wall to the cavity* within extend many muscular fibres, which are sometimes simple and sometimes compound, and are generally disconnected with each other. Two of these muscular threads are more prominent than the rest, and extend from a thickening at the apex of the larva to the junction of the œsophagus and stomach. These are regarded as homologous to those muscular strings in *P. gyrans*, which were long ago noticed by J. Müller, and regarded by him, and later by Metschnikoff, as nervous elements.

From the apical thickening of the walls of the larva there arises a short, flexible flagellum, which waves back and forth as the larva moves through the water. The interior of the larva is occupied by an œsophagus, and an amniotic cavity which contains a growing Nemertine worm. The œsophagus fills almost the whole of the bent portion of the larva under the apex. It opens externally by a mouth with ciliated lips. Internally it is continued into the intestinal cavity of the Nemertean. Its walls are muscular, ciliated internally, and contractile. The external lips are slightly pigmented. No intestine or anal opening was seen in the larva. The interior of the body, from the inner end of the œsophagus to the walls which form the lower pole below the ring of cilia, is taken up by a sac, which has been homologized with the amnion of *P. gyrans*. In this sac is formed the young worm. The most conspicuous regions of the amnion are the upper, which is a prolongation toward the apex from the vicinity of the inner terminus of the œsophagus, and the lower part, near the anal pole, which occupies most of the body of the larva. Both of these regions have the walls of the amnion thickly pigmented, as shown in the figures. In the blind sac which constitutes the upper of these pigmented regions lies the future proboscis of the worm. This last structure is movable in the pigmented sheath in which it lies. It sometimes completely fills its sac, and when withdrawn leaves the pigmented amnion in the shrunken condition shown in the figure. The pigmented regions are composed of small granules of a dark red color closely crowded together. They are represented in Bütschli's figure † of *P. gyrans* by a single large and irregular pigment spot. This amniotic pigmentation is not the same as the colored bodies described by several authors about the rim of the disk and the margin of the oral lappets in the same species.*

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* An *Amnion* such as has been described in *P. gyrans* is already formed in the youngest larva of *P. recurvatum* which was taken.

† In the young of *Polygordius* (Loven's larva), we have described around the margin of the disk a number of problematical bodies, which are very similar to those spoken of by several authors as existing on the rim of *Pilidium*. In both genera they may be foreign bodies, and not patterns of pigmentation. In some specimens of a large undescribed *Pilidium*, found at Newport, they were present; in others, apparently of the same species, absent.

Two different sides may be distinguished in the larva. These may arbitrarily be known as the dorsal and ventral. The term dorsal as here used refers to the flexure of the body diametrically opposite that on which the drooping mouth hangs, while the mouth may be regarded as opening on the ventral side. In the imprisoned Nemertean there is also a corresponding dorsal and ventral side. The worm is fastened to the larval nurse by the ventral region, and is free from the amnion at all other points. It hangs in the amniotic cavity in such a manner that its ventral side lies in the same direction as the ventral side of the larva, and the proboscis extends into the recurved portion and lies in an extension of the amnion above the œsophagus. The posterior end of the body of the Nemertean in older stages of its growth is bent at right angles to its length, the extremity being bent upward on the ventral side.

Fig. 2 represents the youngest larva of *P. recurvatum* as seen from the dorsal side. The proboscis is so drawn back that it does not inflate the upper pigmented region of the amnion. The recurved outline of the upper part is turned away from the observer. The lower portion of the body is short and thick. The diameter from one side to the other is less than that measured dorso-ventrally. The general shape of the larva from this side is pyriform. One of the most prominent organs in the structure of the Nemertean enclosed in the *Pilidium* is a pair of spherical organs (*c s*), shown in both Figs. 1 and 2, just below the origin of the proboscis at its point of differentiation from the body of the worm. These bodies lie one on each side of a dorsal median line, and have lateral openings into the amniotic cavity in which the worm is contained, and are ciliated. They may be known as the cephalic sacs, and are probably the same as the "Saugnäpfe" mentioned by J. Müller. These organs are among the earliest structures to differentiate themselves in the growth of the worm, and in older stages of growth each opens externally on the sides of the head by a small ciliated orifice. Four of these bodies were mentioned by Müller, and Bütschli speaks of and figures four in *P. gyrans*. Two only were seen in this stage of *P. recurvatum*. Another pair is of later growth. In the stages of growth older than Figs. 1, 2, the external shape of the larva is somewhat changed, but the increase in size of the Nemertean contained in and borne about by the free swimming nurse takes place without any changes of great importance in the external contour of the larva.

A larva of *P. recurvatum* slightly older than that represented in Fig. 1 carries its snout in a very exceptional manner. In this larva that extremity of the body which is in the majority of cases simply dependent is carried projected outward at right angles to the longer axis of the body. This mode of extending the mouth was observed in a single specimen, and may have been an individual peculiarity. It shows, however, the capabilities of movement which the snout has.

The proboscis of a worm shown in Fig. 3 is very movable in the sac of the amnion in which it lies. It is here represented as filling the whole sheath, although it seldom remains long in this state, but is drawn back and forth as if even at this early stage in its career its larval life was soon to terminate. The walls of the cavity of the proboscis are well seen in a larva of the age shown in Fig. 2, especially when it is extended so as to fill its amniotic sac. Fig. 4 is another larva of about the same age as that represented in Fig. 3, which carries its snout turned down as in the majority of specimens captured. Fig. 5 is slightly older than Fig. 4, and is a view of the last from the dorsal side. It has at the lower pole a short flagellum, smaller than that found at the apex of the larva, but prominently larger than the majority of vibratile cilia with which the whole external surface of the larval body is covered.

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* Arch. f. Naturges., 1873, Band I.

Figs. 6, 7, 8, represent stages in the development of the worm which show a progressive growth of the contained Nemertean. It will be noticed that the whole larva has considerably lengthened its body and become slighter, while the pigmented sac which encloses the proboscis has become much larger. It is also to be noticed that the projecting snout upon which the mouth of the nurse is situated has become contracted in size, and that, as shown in Fig. 7, it has dwindled to a slight prominence. The œsophagus also keeps pace with this reduction in size of the projection in the cavity of which it lies.

In Fig. 9 the relative size of the "nurse" and the contained Nemertean is very different from that shown in previous figures. The proboscis now forms a large and prominent body in a pigmented amniotic sac, filling most of the upper portion of the larva. It moves back and forth in a most restless manner within its prison walls, and seems attempting to escape. The muscular threads which formerly united the apex of the larva with the cavity have disappeared. The lower end of the worm has grown so long that it is folded upward on the ventral side of the nurse, reaching a short distance above the region of the larva in which the ring of cilia lies. The whole of the amnion in which the posterior end of the worm lies is pigmented a fine dark red color similar to that upon the proboscis. On the ventral side of the Nemertean there is an enlargement which is the unabsorbed part of the contents of the amnion transmitted from younger conditions of growth. The walls of the amnion fit tightly upon the worm within, but in places they can be very easily distinguished from those of the worm. The cephalic sac is well marked, the cavity of the proboscis clearly evident, and a well-marked organ on the dorsal side of the Nemertean is probably the primitive formation of the dorsal water-tubes.

In Fig. 10 is represented the oldest *Pilidium* which we have observed. The contained worm has outgrown its narrow confinement, and there remains one important change by which it can extricate itself. If in order to hasten on this change, somewhat akin to evisceration, the larva be put in a small quantity of water, as in a watch crystal, the worm thus confined will be observed to move in the amniotic cavity even more briskly than before, and to fret more strongly against the barrier which envelops it. This hastens on the "critical stage," similar in some respects to a metamorphosis which has been described in some Gephyrean worms. The enclosed Nemertean, drawing back its proboscis out of the pigmented sheath, protrudes it outside the body walls through an orifice at the lower end of the larva. In a single specimen (Fig. 15) in which the "critical stage" was observed, this opening was seen below the ring of cilia on the lower end of the larva. After resting a moment, suddenly, either normally or abnormally, the half-protruded proboscis is forced still farther outside the larva, turning the *Pilidium* in such a way that it is everted, and appears as a shrunken remnant, forming a marked enlargement at the posterior end of the body. No part of the "nurse" is unabsorbed, and even the pigmented regions of the amnion described above can be detected in the enlargement which characterizes the posterior extremity of a Nemertean which has just passed through the critical stage. In other species of *Pilidium* a majority of authors declare that the original larva, with its enclosed amnion, lives independently for some time after the escape of its Nemertean. Such is not the case in a single specimen of *P. recurvatum*, which was made to pass through the critical stage in the way described above. The body of the larva with the amnion is here absorbed into the posterior end of the body of a growing worm, which it carried in a way not unlike that in which the pluteus bears the young Sea-urchin. The absorption of the larval envelope in *Pilidium recurvatum* is in reality a true Echinoderm feature, and seems to me one more characteristic pointing to the close affinities of these worms and the Echinoderms.

The form of the worm, after it has passed through the wonderful metamorphosis which has just been described, is shown in Figs. 11 and 12. It is now no longer free-swimming, as formerly, and, although ciliated over its whole exterior, is slow moving, and immediately sinks to the bottom of the aquarium in which it is confined. The worm just after the metamorphosis from the *Pilidium* is elongated in shape, pointed at the anterior, and swollen almost globular at the posterior extremity. It is ciliated on its whole external surface. The body is semitransparent, and large patches of pigment appear in the enlargement at the posterior end of the body. Cephalic sacs, with ciliated linings, are well marked, but no eye-spots are seen on the head of the Nemertean immediately after its escape from the *Pilidium*. According to Bütschli the fully grown *Nemertes* of *P. gyrans* is probably destitute of ocelli. In the few specimens of *P. recurvatum* which were found at Newport, no ocelli were observed, while the worm was contained in the amnion previous to the critical stage, and it was only later that the two eye-spots were formed. The oldest form which we have obtained of the Nemertean derived from *P. recurvatum* is yet a long distance structurally speaking from the adult, but yet has so many resemblances to *Lineus* that I have referred it provisionally to this genus. Its general appearance from the dorsal side is shown in Fig. 14.

Many prominent differences between this and the last stages which have been described are found in the general outlines of the body. The great enlargement at the posterior extremity of the worm just escaped from the larva, as shown in Figs. 11, 12, and 13, has become reduced in size, so that now the greatest diameter is found just behind the cephalic sacs, and the body tapers from this point backward to its posterior end. The larva has three pigmented regions, viz. the very anterior end of the snout, the region just behind the cephalic sacs, and the posterior end of the body. The eye-spots are found on the sides of the head just in advance of the cephalic sacs. These last-mentioned organs are relatively smaller than formerly, and are ciliated in their interior and on the inner walls of the tubes which lead to them from the external orifices.

The internal organs differ slightly from those of the adult *Lineus*. A large stomach, the movements in the walls of which could be easily seen, fills most of the interior of the larva. There is in this larva no visible anus. The sinuous tube (*w t*) which lies on the dorsal side of the stomach has been identified as a water vessel. A similar organ is figured by Leuckart and Pagenstecher in *P. gyrans*.

The form of this singular larva and the strange development of the enclosed worm suggest very interesting theoretical questions. The external outlines of the larva ally it to animals widely separated in our classification from the Nemertean to which it gives origin. Busch, Leuckart and Pagenstecher, and others, have pointed out that in the similar relationship of *Nemertes* to its *Pilidium* we have a parallel condition to that which exists between an *Echinus* and its *pluteus*. In the species of *Pilidium* which they studied, not only the stomach of the larva, but also its œsophagus and mouth, were found to be directly changed into the same organs in the contained Nemertean. In *P. recurvatum* the resemblance which they suggested is even closer than in those species which they have studied, for here not only is the larval mouth and œsophagus only indirectly if at all changed into the same organ in the adult, but also the lower portion of the embryo has a true brachiolarian form which is highly suggestive. Our larva, even more than those of other species of *Pilidium*, shares with *Tornaria* and *Actinotrocha* many Echinoderm characteristics.

The history of the opinions which have been advanced by Müller, Busch, Leuckart and Pagenstecher, Huxley, A. Agassiz, and others, in relation to the resemblance or want of likeness of *Tornaria* to the young Echinoderms, is too well known to be repeated here. If *Balanoglossus* were the only worm whose larva resembles the young Holothurian, the fact might be explained by the abnormal character of the adult. With the Nemerteans, however, the case is somewhat different, for in them we have a large group, whose larvæ have many points of resemblance to the embryonic Echinoderm. Nowhere is that likeness carried so far as in the strange *Pilidium recurvatum*, which has been described above. It would seem at first sight that the circular belt of cilia described in this larva would be an argument against its close affinity with the larval Echinoderm. The same thing may be said of this, which has already been said of a similar belt in *Tornaria*. Far from being an unknown feature, it is a peculiarity in some Echinoderm young, as in *Comatula* and the Holothurians, which are the closest allies of the worms. We find in some young

Holothurians the body girt by several parallel belts of cilia. One only of these rings of large cilia remains unchanged in *Tornaria* and in *Pilidium recurvatum;* but in the former genus two others, very much modified in position and never parallel, form the loop-like bands between which the mouth opens. These bands, quite simple, as I shall later show in the young *Tornaria*, have a very tortuous course later in their career, but never attain the complexity which marks the course of homologous bands on the young of our common Starfish or Sea-urchin. Much greater than its resemblance to the young Echinoderm is the likeness of our new *Pilidium* to the well-known *Tornaria.*

On the same plate with my figures of the larvæ of *P. recurvatum* are introduced for a comparison two illustrations of very young stages in the growth of *Tornaria* (*Balanoglossus*). These are still younger than any larvæ which are yet known of our American *Tornaria*, and present many very interesting features. The closeness of the relationship between them and the younger members of the series of *Pilidium* which they accompany is not the least interesting of the many comparisons which they suggest.

In the youngest (Fig. 16) we have a *Tornaria* of an irregular pear-shaped form, with well-marked œsophagus, stomach, and intestine. A mouth opens on one side of the body and an anus is found at its lower pole. The external surface of the body is crossed by two simple ciliated bands. These have a common union at the upper pole of the larva, but a very divergent course on its external surface. The shorter of these ciliated bands forms a loop varying slightly from the form of a ring, which extends from the upper pole nearly to the equator, but never into the lower hemisphere. The larger band has a more tortuous course than the other, which it resembles in its loop-like form. It is much longer, and extends into the lower hemisphere almost to the lower pole. It meets in its course the smaller band only at one point, which is at the upper pole of the embryo. The mouth opening of the young *Tornaria* lies on its equator under the eaves of a projecting upper hemisphere, and between these two ciliated bands. At the common junction of the two ciliated bands is found a pair of eye-spots, above which rises a small tuft of cilia. The *Tornaria* swims with this region uppermost in the water. From that part of the larva upon which these ocelli are borne, extending internally to the neighborhood of the union of œsophagus and stomach, passes a muscular thread very similar to like threads already mentioned in *Pilidium.* An unpaired tube extends from the point of union of the œsophagus and stomach, on its dorsal side, to the middle of the dorsal flexure, opening externally by a "dorsal pore" about diametrically opposite the mouth. The sac or enlargement of this tube at its inner terminus has not yet reached any great size.

In this youngest *Tornaria* there are, as appears also in Müller's original description of *Tornaria, no ring of large cilia* near the anal pole and *no lateral bodies* ("lateral plates," "lappets," A. Agassiz) by the side of the stomach, such as we find in the older *Tornariæ.* All theoretical questions which consider a comparison of these last bodies to the water-tubes of the Starfish larvæ must take cognizance of the fact that the median water-tube, which passes to the dorsal flexure from the internal end of the œsophagus, is fully formed before any trace of the anal ring of cilia or the lateral bodies ("lappets") found near the stomach have appeared.

The second of the two figures of *Tornaria* (Fig. 17) is taken from a larva still older than the last, from which it differs in one or two particulars. The most important character which has been acquired in the growth of the former is a belt of cilia not far removed from the anal pole, which is found in all later stages in the development of the worm up to its metamorphosis into *Balanoglossus.* The same ciliated belt we also find in the larva *P. recurvatum*, the young of the Nemertean worm which we have studied, but it does not exist in the known species of *Pilidium*, which are the nearest allies of our new Nemertean larva. It is, however, represented in *Actinotrocha.*

A noticeable fact is that the lateral bodies found near the stomach in older *Tornariæ* have also not yet appeared in the growth of the internal organs at this stage of development.

There is another difference between the second and the first of these two larval youngest stages of *Tornaria.* On either side of the œsophagus, originating from the inner end of the muscular thread which arises from the eye-spots at the apex of the larva, is found a pair of rein-like bodies in the form of threads, which extend to points on either side of the mouth. It is not known what their function is, but their position is the same as that of like threads which have been described elsewhere in this paper, for the first time, in our common Loven's larva, similar to its European representative, referred by Schneider and Hatschek to the strange genus *Polygordius.* There is also another characteristic in the very young Loven's larva never yet observed by others, which seems to me of some importance in theoretical questions concerning the affinities of *Polygordius.* A very young Loven's larva was found, in which a long vibratile cilium is borne upon the apex, just as has been mentioned in *Pilidium* and the larva of the above-described Nemertean. Moreover, this cilium, which has the character of a flagellum as far as size goes, rises from a specialized portion of the body of the larva upon which eye-spots are borne. The flagellum in Loven's larva is an embryonic structure, and the portion of the larva which carries it is directly changed into the head of the future worm. In the Nemerteans, however, the flagellum is embryonic, like that of Loven's larva, but the body of the larva plays no part in the formation of the head of the worm, but by its wonderful metamorphosis makes the whole posterior extremity of the larva. No *Tornaria* has been observed with this flagellum at its apex, unless we homologize with it a small tuft of cilia larger than the others on the surface of the body, found at the apex of our youngest larva. Close as the resemblances between *Tornaria* and *Pilidium recurvatum* are, there are many very intimate relationships between the latter and the young of the Gephyrean worm *Phoronis* when known as *Actinotrocha.* The rapidity of the transformation of the *Pilidium* into the Nemertean, more especially the apparent evisceration and turning inside out of the larva at that time, led me at first to regard my larva as the young of some unknown worm allied to

Phoronis. Indeed, I have borrowed from those who have written on the metamorphosis of *Actinotrocha* the term "critical stage," on account of this likeness. I have no hesitation now in identifying *Pilidium recurvatum* as a young Nemertean, rather than a young Gephyrean, although I am doubtful whether I know the generic name of its parent.

Prominent among the characteristics which *Pilidium recurvatum* shares with *Actinotrocha* is the existence in both of a belt of cilia which divides the body into such unequal parts. These regions thus marked out resemble each other in general shape, and probably, if a younger larva of *Pilidium* could be compared with those already known of *Actinotrocha*, before the arms had formed, even closer resemblances might be traced between them. Whatever likenesses there are earlier in the internal organs, they have now been completely masked by the progress of the development. It is very difficult to compare the youngest known *Pilidium recurvatum* with *Actinotrocha*, as far as the internal organs are concerned, notwithstanding there is such a similarity in external outlines.

Polygordius ("Loven's Larva").

Plate II.

The writings of A. Agassiz, Schneider, and Hatschek,* on the development of the very common larva known as Loven's larva, have given a history of its metamorphosis from a somewhat advanced larva into the adult form. All is still dark, however, in regard to the segmentation of the egg and the earliest forms which the larva passes through. As any contribution to either of these parts of the subject must have a value, figures and descriptions of two larvæ younger than any of this worm yet described are here introduced. These take us one step nearer a complete knowledge of the growth and early history of this most interesting worm.

Loven's larvæ are among the most common Annelid larvæ taken in the dip-net at Newport. They are found in all conditions and of all sizes, sometimes swarming in numbers in the collecting glasses. The youngest larva which was found, Fig. 10, has a general structure as follows.

The body of the larva is spherical, transparent, and as gelatinous as that of a Medusa. In its movements in the water it tumbles about, moved principally by the strokes upon the water of an equatorially placed double belt of cilia. The larva has a slightly irregular spherical form, rounded above, somewhat flattened below, and girt midway by two † rings of motor cilia. The hemisphere above these ciliated bands may be called the upper hemisphere, and that below the lower. The upper hemisphere is, with the exception of a slight prominence on one side, regularly rounded and dome-shaped ; the lower is flattened, broken by an eccentric protuberance on one side. Both mouth and anus open through the lower hemisphere ; the former on one side just below the upper of the equatorial ciliated bands, and the latter on the eccentric prominence already mentioned. The whole exterior surface of the body is ciliated, and the equatorial band consists of two parallel rings, which extend side by side for most of their course, and separate from each other in the region of the mouth, the larger passing above and the smaller below this orifice. This position of the two ciliated rings in an older larva can be seen in Loven's original figures of the European larva. The upper hemisphere has its walls unbroken by any orifice, and is of regular dome-like shape. At its pole arises a short flagellum (*f*), which waves back and forth as the larva moves through the water. The flagellum found at its apex is an embryonic structure, and appears to be lost in more advanced larvæ. On the body walls just below the pole, in a granular zone surrounding the point from which the flagellum arises, there is a collection of cells more or less scattered, the thickness of which decreases more and more near the ciliated equatorial band. This granular mass is the first appearance of that nervous centre which later aggregates about this pole of the larva, and bears the ocelli. Slightly removed from the base of the flagellum, in the walls of the larva, are two pigment spots, one on each side, with well-marked lens, which as the larva grows older and older approximate closer and closer, until they are brought into the immediate vicinity of the pole, in connection with the consolidated collection of cells already mentioned. In the youngest larva, however, they are widely separated ; later, they grow nearer each other. Two prominent clusters of cells (*c d*) are found in the lower hemisphere in the walls diametrically opposite the cluster on the upper hemisphere. These also later form a nervous centre at this extremity of the worm. Around the rim of the larva, in the slight ring-shaped protuberance from which the cilia arise, many brown and yellow colored cellular bodies (Fig. 10^a, *p*) of a problematical character can be found. These bodies vary somewhat in color and size, being generally brownish, yellowish, or greenish, and have a regular spherical shape. They appear to be suspended in membranous dilatations of the disk rim, and to hang from it by a slight attachment. Their disposition on the bell margin is irregular, and not constant. Can this be an instance of the symbiosis of an algous growth on a worm larva ?

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* According to the last-mentioned authors, Loven's larva is the young of the strange genus *Polygordius.*

† See Balfour, Treatise on Comparative Embryology. Our *Polygordius* larva is like the European in having two ciliated belts.

The interior of the larva is occupied for the most part by three cavities, each with its own walls separate from those of the body cavity. Two of these have external openings into the medium in which the larva lives. The greater part of the interior of the larva is occupied by the largest of these three organs, which is called the stomach. This structure, which is almost globular in shape, has two openings, one into each of the two smaller cavities. It does not communicate with the surrounding water, and its whole inner surface is ciliated. Of the remaining two internal sacs, one is an œsophagus, and the other an intestine. The œsophagus opens externally through the mouth, and internally into the stomach. Its walls are muscular, contractile, and the inner surface is ciliated. Granules of food in masses were observed in its cavity.

The intestine is more globular in shape than the œsophagus, opening internally into the stomach, and externally through the anus. Its inner walls are ciliated, and its cavity is partially filled in many specimens with fæces.

In a second slightly older larva (Fig. 11) of *Polygordius*, several additions in structure have been made, and marked modifications in form have taken place. In the general outline, the most important change is the flattening of the whole larva, especially on the lower hemisphere, by which the equatorial axis is relatively very much increased. The flagellum on the apex of the upper hemisphere has disappeared, and the two ocelli have drawn still more closely together; so that both now lie very close to the apical pole. The stomach has become more elongated in shape, while the œsophagus has assumed a more tubular form. The beginnings of the funnel-shaped bodies described by Hatschek in the European Loven's larva can be seen as two globular sacs (*e*), one on each side of the stomach, on a level just above a plane passing through the equatorial ring of cilia. Two prominent fibres arise from the collection of cells upon which the ocelli are placed, and pass to the lips above the mouth. Two other threads have a similar origin, and extend meridionally on each side of the stomach to the clusters of cells on the inner walls of the lower hemisphere, at the anal pole of the body. A third pair of threads, hitherto unnoticed, take their rise from the same clusters of cells at the anal pole, and extend parallel with each other to the lower lips of the mouth. They end near two pigment bodies which are constantly found in this region.

The different larval stages in the development of Loven's larva which lie between that represented in Fig. 11 and the adult Fig. 18 have been figured by Hatschek for the European species, and for the American representative by A. Agassiz. New figures of the American larva are introduced in order to show the peculiar brown bodies found about the bell margin, which seem to be characteristic, and the two ventral "nerve cords" shown in Fig. 14, *v n*, which are unrepresented in any drawings of these larvæ which have been published. With the exception of these two differences, our common Loven's larva is similar to the European.

Capitella (young).

A larva referred to the genus *Capitella* has been taken several times in our Newport fishing. These were always in the same condition as that figured in Plate III. Figs. 19, 20, and do not differ essentially from one already represented by Claparède and Metschnikoff.*

Lumbriconereis.

Plate VII.

The cove near the laboratory is the home of many genera of Annelides which live in the fine mud covering the bottom in many places. In the months of June, July, and August, a plentiful supply of eggs in all stages of growth, which were identified as belonging to the genus *Lumbriconereis*, were collected at low tide from this locality. They were found attached to the surface of the mud in the form of gelatinous clusters glued together in spherical masses of slime, which, when the flats are covered with water, wave to and fro with passing currents. In size and general external appearance, they closely resemble similar clusters of mollusk eggs found in the same place. The worm embryos, however, have a more greenish color than that of the mollusk, and can after a little practice be distinguished by the unaided eye.

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* *Op. cit.*

The segmentation of the *Arenicola* egg, which is identical with that of *Lumbriconereis*, has been described and figured by several naturalists, so that the changes which take place in the egg up to the formation of the planula are well known. The series of larval forms which are described and figured in this paper opens with one where a segmentation of the ovum is completed, and extends to a larva in which certain generic structures of *Lumbriconereis* are well marked.*

In Fig. 1 we have represented the egg at that period in its development when the smaller spheres, " micromeres," have partially grown about the larger "macromeres," two of which seen in profile appear at one pole. When the pole at which the macromeres lie is seen from above, so that they occupy the centre of the circle of vision, four macromeres surrounded by the encroaching micromeres can be easily seen. When viewed in profile, as in the figures given, only two of the larger spheres appear. In an egg a little older, the forming micromeres encroach still more on the pole at which the macromeres approach the surface of the ovum, until ultimately the latter are wholly surrounded by the smaller cells.

The youngest of the planula series has a spherical and slightly ovate form, bearing at one pole a clear projection easily distinguishable from the remaining parts of the embryo. This projection may be called a cephalic prominence. The whole interior of the larva is occupied by large nucleated cells, which are easily seen through a transparent outer layer. On the pole opposite that capped by the transparent cephalic projection which has been mentioned, there has been differentiated from the outer surface a thin layer which marks the beginning of the body of the worm. The cap-shaped cephalic prominence at the upper pole is the first appearance of a head. The whole external surface which lies between these prominences of the larval body is a broad ciliated zone, which occupies the greater part of the external surface of the worm.

The first important additions to a simple larva girt by a broad band of cilia, which we have just described, is the formation, at either pole, in the clear spaces which we have mentioned, of small prominent pigment spots. Five of these are formed at the cephalic, and four at the caudal pole. Those which appear in the cephalic prominence are three in number, placed one medially, with one on each side near the pole, and one on each side near the equatorial band of cilia. The caudal embryonic spots are arranged in a row side by side, near the lower or caudal pole. From each pigment spot, cephalic or caudal, pass towards the centre of the larva a number of delicate threads, which are ultimately lost in the larval body. The cephalic protuberance is formed of two layers, an outer transparent, and an inner more opaque. The large cells, macromeres, in the interior of the larva, are smaller in number, and do not occupy as large a part of the embryo as formerly. The ciliated band has narrowed relatively to the length of the whole embryo.

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* These larvæ resemble closely the young *Arenicola marina* (*piscatorum*) of Max Schultze (Abhand. d. Natur. Gesell., 1856), or those of *A. cristata*, Stimp., described by Dr. E. B. Wilson, *op. cit.* The larvæ doubtfully referred to *Lumbriconereis* by Claparède and Metschnikoff (*op. cit.*) are generically different from mine.

Fig. 4 is taken from a larva still older than the last. In this embryo, the cephalic protuberance has been but little changed, while the caudal has grown much larger than formerly. The most important additions in this embryo are two rows of lateral pigment spots on the posterior margin of the ciliated band. These lateral spots persist into very late stages in the growth of the worm, and are identical with those collections of pigment found on the auricles which bear embryonic cephalic spines in *Nerine*, *Spio*, and other genera. The row of lateral ocelli (?) cross the body of the embryo following the lower edge of the ciliated band in an oblique direction. Around the dorsal surface of the larva the ciliated band is uniform in breadth, but on the opposite or ventral side it contracts and narrows to fully two thirds its former width. The oblique direction of the lateral lines of pigment is due to this narrowing of the ciliated band. Posterior to the narrowest part of the ciliated band is a clear space, into which, on the ventral side, the mouth opens.

The posterior or caudal portion, which is in reality the growing body of the worm, now becomes more elongated, and the two layers which form its walls become more and more evident. The central part is not yet differentiated into stomach and intestine, but is made up of large and small clusters of original macromere cells.

In Fig. 7 is seen the formation of the first body segment with its solitary spine. The head is now more pointed than formerly, and through its walls, near the upper margin of the ciliated band on the ventral side, two small clusters of cells, the origin of the infraœsophageal ganglia, appear. The body has become more elongated, and is swollen midway in its course, at the points in which the first parapodia are formed. One or two more pigment spots have formed at the posterior terminus of the body.

The spines first appear as needle-like bodies, enclosed in the lateral walls midway between the posterior border of the ciliated band and the caudal pole of the embryo. It is only after they break through the walls which surround them, and greatly increase their size, that their extremity is modified in the manner shown in the figure.

In Fig. 8, a still older larva than that last described, it can be seen that the spines of the first parapodium have already broken through the external body walls, and a second segment has begun to form behind the first. As in the former only a single spine at first appears on each side, so here there forms on the second parapodium a simple spicule imbedded in the body walls. The whole worm has lengthened very considerably, and a mouth has broken through into a clear space beneath the ventral surface, the beginning of the œsophagus. No ciliary ring has yet appeared at the anal end of the larva.

The embryo, although possessing spines which can be projected from the body, and a ring of cilia about the head, is still with others enclosed in the mass of slime in which they were laid. All have very limited movements, even when artificially set free from the cluster in which they are bound together. Their bodies, especially the central part, have a dirty green color, while the head, ciliated band, and body walls are more transparent.

In the subsequent changes which the external form of the larva passes through, there is little of interest to be mentioned. Parapodium after parapodium is added, increasing the length of the body of the worm. The new segments always arise back of that which is previously formed, while in advance of all, between the first body segment and the posterior border of the ciliated band, marked on the sides by the lateral rows of pigment spots, there are no lateral appendages to the external body walls. From its position and its subsequent history, this bare part of the body immediately behind the head is probably homologous with the anterior body region (*a r*, Fig. 1), which has been already elsewhere described in the genus *Prionospio*.

In my figure of the larval *Lumbriconereis* with two pairs of well-formed spines, it will be noticed that the digestive tract has already differentiated itself into two regions, an anterior, larger, and more capacious, and a posterior more tubular portion. The former of these is later changed into the stomach, while the latter is destined to form the intestine. The point of separation of one of these from the other is not yet well marked.

At the anterior end of the stomach, on one side, a globular body is constricted from the stomach walls at about this time. The ultimate history of this organ has not been traced, and its function is unknown. A similar body has been mentioned in the young *Nephthys*. The jaws in the larval, as in the adult *Lumbriconereis*, are very complicated, and consist of two parts, a dorsal and a ventral. The ventral jaw is formed of a single crescentic chætinous plate, the horns of which extend forward. The regularity of the concavity of the anterior edge of the jaw is broken by a single small median tooth. The posterior edge of the jaw is continued backward into two elongated projections, which extend parallel with each other, and are separated by a narrow slit.

The dorsal jaws are still more complicated than the ventral. They consist of four pairs of chætinous articulations which act as teeth, and are arranged in pairs the members of which are placed opposite each other. The two anterior of these are simple teeth with smooth edges, the former with a triangular outline ; the latter is more elongated, narrower, and more pointed.

The body of the dorsal jaws is formed of two flat or slightly curved oblong plates, whose opposite edges are serrated. By the approximation of these borders, the true function of this complicated mechanism is accomplished. To these oblong, serrated plates, on their posterior border, are articulated the last pair of bodies which form the dorsal jaws. These take a triangular shape, and have for their function a firm attachment for the remaining parts of the jaw.

They have a ligamentous junction with the posterior border of the oblong serrated plates which form the body of the jaw.

In their simplest form there is a remote resemblance between these jaws and the chætinous teeth of the species of *Branchiobdella* found parasitic on the crayfish.

Nectonema agilis Verr.

Plate VIII.

Almost every summer for a number of years we have captured at Newport a worm of doubtful affinities, which seems to be the same as that described by Prof. Verrill as *Nectonema agilis*.* The only description of *Nectonema* known to me is found in the Proc. Nat. Mus., 1879, p. 187. The present account will be found to confirm in the main the excellent observations recorded there by Prof. Verrill, and I hope add something to what little is at present known of its highly interesting anatomy. As no figures have yet appeared of this worm, a few are introduced in Plate VIII. to illustrate its general form.

Three specimens of *Nectonema* were collected in 1883. These were found free-swimming, and were taken in evening fishing

The body is long, thread-like, round, with the lateral lines slightly flattened. It has a light brown or straw color and nearly opaque walls. *Nectonema* moves through the water with great rapidity, coiling and uncoiling itself with tireless energy as it swims. The length of the body varies in the specimens studied, from four to six inches.

The external body walls are smooth and unsegmented. Generally opaque, in some specimens internal organs can be seen through its sides. The two extremities are for the most part the most transparent.

From one extremity to the other on each side there extends a well-defined, broad, lateral band, which is laid out in squares marked in outline by black pigment. This superficial marking may define a deeper anatomical segmentation, or it may be confined to the surface of the body and the walls immediately adjacent below the surface. Each square is separated from its neighbors by a raised band. The dorsal † sides of the squares appear the most densely pigmented. A granulated line of cells extends from one end to the other through all the lateral squares which make up the lateral bands.

In some specimens there is found on the lateral bands two rows of hairs closely crowded together, so that they sometimes appear in bundles. These hairs seem to be connected by a muscular web, and are generally covered with mucus and foreign matter which has become attached to them.

Although the two extremities closely resemble each other, there exists a marked difference between them in minute anatomy.

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* My attention was called to his description by Prof. Verrill, on being asked to identify one of my specimens.

† Dorsal and ventral lines of the body of this filiform worm are very difficult to distinguish.

The anterior end (Figs. 5, 6, 7, 8) is blunter than the posterior (Fig. 10), and in one specimen has a clear cavity within, easily seen through the cephalic walls, in which, as Verrill has already mentioned, four transparent, nucleated, cells lie. The mouth cannot be observed very distinctly, but is discovered by close observation on the ventral side of the head as a narrow longitudinal* slit. There are no cephalic tentacles or other appendages to the head. A pigment spot was noticed in the walls of the head just in advance of the transparent region, but whether it is an ocellus or not was not determined. The digestive tract, which is of varying diameter, but always small as compared with that of the body cavity, extends from one extremity of the crown to the other. The walls are muscular, and at times have a rhythmic pulsatile motion, which may be seen through the body walls. The anus is terminal, and mounted on a curved caudal prolongation of the body, slightly enlarged at its extremity. According to Prof. Verrill the posterior end of the male and female *Nectonema* differ from each other, and he speaks of a peculiar "papilla" found in this region of the female.

The stomach and intestine often become so inflated that they fill the body, so that they cannot be distinguished from those of the body cavity. The "yellowish white organ [ovary ?] extending from near the head to the tail," mentioned by Prof. Verrill, was observed in one specimen.

The affinities of this singular worm with known genera are somewhat doubtful. Prof. Verrill, with an implied expression of doubt, refers it to the Nematodes. That reference seems to me a proper one, but from what little is known of its anatomy it can find few near relatives among the genera now known in this group of worms. It must, if a Nematode, take its place near the *Chætosomidæ*, or perhaps by the side of that strange worm *Eubostrichus*, of even more problematical affinities, described by Greef,† from the North Sea. If near the latter, it is as a giant with a pygmy, for *Eubostrichus* is but 8 mm. in length, while *Nectonema* is ten times as large. The matted covering, formed of hairs, which characterizes *Eubostrichus* according to Greef, does not exist in *Nectonema*. There is, however, a tendency for something like this covering to form on the hairs along the lateral lines. *Nectonema* is a genus with close affinities on the one side with the Nematodes, while on the other it presents strongly marked Chætopod characters. The segmentation so pronounced on the lateral bands, and the double row of hairs upon the sides, point to the Annelides as its nearest allies. The connecting web of the lateral hairs recalls the lateral fins of *Sagitta*.

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[*] In Prof. Verrill's specimen, "a *transverse* whitish band seemed to indicate the position of the mouth."

[†] Arch. f. Naturg., 1869.

CAMBRIDGE, December, 1883.

EXPLANATION OF THE PLATES.

PLATE I.

Prionospio tenuis Verr.

a r.	Anterior region of the body.
a g.	Anal gland.
b t.	Basal joint of the tentacle, which, as the larva grows older, increases its size at the expense of the embryonic tentacle (*t*).
c h.	"Crochet hook" spines.
g.	Glandular body which originates as a sac-like prolongation of the stomach cavity, becomes pigmented, and is ultimately lost in older larvæ.
h.	Heart.
m.	Mouth.
m s.	Cluster of pigment spots found on the fourth body segment.
o.	Ocellus.
p.	Proboscis.
p l.	Præoral lobe.
p r.	Posterior region of the body.
s.	Embryonic setæ.

Figs. 1, 2.	Young larvæ of *P. tenuis.*
" 3.	Young of the same, a little more advanced in age.
" 4.	Head of the last larva from the ventral side.
" 5.	Still older larva in which an articulation has appeared at the base of the cephalic tentacle.
" 6.	The same, with the cephalic setæ pressed to the sides of the body.
" 7.	Still older larva.
" 8.	Side view of the last.
" 9.	Ventral view of the head of the same.
" 10.	Side view of an older larva.
" 11.	Older larva, in which the cephalic spines have disappeared (dorsal view).
" 12.	More developed larva in which the provisional cephalic tentacles have been replaced by the permanent branchiæ.
" 12 .	Posterior segment of the last larva (dorsal view).
" 13.	Oldest observed larva of *P. tenuis.*
" 13 .	" Crochet hook" spines of posterior segments.
" 13^b.	One of the same magnified.

PLATE II.

Spio, Aricidea, and Polygordius.

a.	Anus.
at.	Tuft of cilia arising from the caudal extremity of the body on the dorsal side of the vent.
c.	Cluster of cells near the anal pole of the larva.
cs.	Ciliated pits.
d.	Cluster of cells which later concentrate into a cephalic ganglion.
e.	Funnel-shaped organ described by Hatschek.
f.	Flagellum.
frs.	Larger ciliated belt.
i.	Intestine.
ln.	Lateral nerves.
m.	Mouth.
mp.	Pigmented bodies on the lower lip.
n.	Nerve from apical ganglion to upper lip.
o.	Ocellus.
œ.	Œsophagus.
p.	Spherical bodies on rim of the disk.
r.	Characteristic pigment band on the dorsal region.
s.	Stomach.
srs.	Smaller ciliated belt.
u.	Transparent projection on the dorsal side at the junction of anterior and posterior body regions.
vn.	Ventral nerve, extending from the caudal end of the larva to the spherical bodies found on the lower lips.

Fig. 1. *Spio* larva (dorsal view).
" 2. More advanced larva of the same.
" 3. *Spio* larva (side view).
" 4. *Aricidea* larva (dorsal view).
" 5. The same, with embryonic spines elevated.
" 6. Older larva of *Aricidia.*
" 7. Youngest larva of *Prionospio tenuis* Verr.
" 8. Posterior region of the last.
" 9. *Capitella* larva.
" 10. Youngest "Loven's Larva" (*Polygordius*).
" 10^{a}. The same, from above.
" 11. Still older larva of the same.
" 12. Older Loven's Larva.
" 13. More advanced larva (side view).
" 14. View of the same from above.
" 15. Magnified portion of the rim of the last.
" 16, 17. Pigmentation of posterior end of *Polygordius* larva (16, anus closed; 17, cloacal wall extruded).
" 18. Adult *Polygordius* raised from the above larva.

PLATE III.

Lepidonotus, Telepsavus, and Phyllochætopterus.

a.	Anus.	*œ.*	Œsophagus.
b.	Branchiæ.	*pl.*	Præoral lobe.
e.	Elytron.	*s.*	Stomach.
i.	Intestine.	*t.*	Tentacle.
m.	Mouth.	*vg.*	Ventral gland.
ms.	Modified fourth segment.		

Fig. 1. Side view of a young larva of *Lepidonotus.*
" 2. Ventral view of a still more advanced larva of *Lepidonotus.*
" 3. Older larva of the same.
" 4. Oldest larva of *Lepidonotus* (dorsal view).
" 5–15. *Telepsavus* (?). (Figs. 8–15 drawn by A. Agassiz.)
" 5^{a}. Youngest larva of *Telepsavus* (dorsal view).
" 6. Older larva of *Telepsavus* (ventral view).
" 7. Side view of the last.
" 7^{a}. Tail of the last.
" 8. Older larva of *Telepsavus.*
" 9. Side view of the last.
" 10. Side view of a still older larva.
" 11. A larva still older (dorsal view).
" 12. Oldest *Telepsavus* larva.
" 13. Mouth and præoral lobe of the same.
" 14, 15. Differently formed spines of the oldest larva.
" 16–18. Larvæ of *Phyllochætopterus* (?).
" 16. Youngest larva of *Phyllochætopterus.*
" 17. Side view of the same.
" 18. Older larva of the same.
" 19, 20. Larvæ of *Capitella.*
?

PLATE IV.

Nephthys and Lepidonotus.

dc.	Dorsal cirrus.	*m.*	Mouth.
i.	Intestine.	*ps.*	Pigment spots.
j.	Jaws.	*s.*	Stomach.
k.	Cephalic spots (ocelli ?).	*vc.*	Ventral cirrus.

Fig. 1. Youngest larva of *Nephthys.*
" 2. Older larva of the same.
" 3. The same.
" 4. Still older larva from the ventral side.
" 5. Later stage (ventral view).
" 5^{a}. Lateral view of the last.
" 6. Larva with well-developed parapodia.
" 6^{a}. Single parapodium of the same.

Fig. 6^{b}. Serrated spine of parapodium.
" 7. Larva of *Nephthys* older than the last. View from the dorsal side.
" 8. The same. View from the ventral side.
" 9. Larva of *Nephthys* in which the cephalic tentacles have begun to form.
" 10. The same. View from the dorsal side.
" 11. Still older larva.
" 12. Oldest larva of *Nephthys*.
" 12^{a}. Head of the same.
" 12^{b}. Parapodium of fourth segment.
" 13. Larva of *Harmothoë* (?).
" 13^{a}. The same seen from above.
" 14. Youngest larva found of *Lepidonotus squamatus*.
" 15. The same, more advanced in growth (lateral view).
" 16. More advanced stage of *Lepidonotus* than the last (dorsal view).
" 17. The same (ventral view).
" 18. Telotrochal larva allied to the young of *Polygordius*.

PLATE V.

Pilidium (?) and Tornaria.

a.	Anterior end of the worm.
c o.	External opening of the cephalic sac.
c s.	Cephalic sac.
d p.	Dorsal pore.
i.	Invagination in the lateral wall of the larva.
m.	Mouth.
œ.	Œsophagus.
r.	Half-absorbed remnant of the larva.
s.	Stomach.
w t.	Water vascular system.

Fig. 1. Youngest Nemertean larva with well-developed œsophagus and stomach.
" 2. Dorsal view of the same.
" 3. Older larva with extended snout.
" 4. Larva still older than the last.
" 5. Dorsal view of the same.
" 6. Older larva with lengthened proboscis.
" 7. Larva just before the extrusion of the worm.
" 8. Larva of the same age as that shown in Fig. 3, yet without cephalic sacs.
" 9, 10. Larva just before the birth of the contained Nemertean.
" 11. Young worm just transformed from the larva.
" 12. Dorsal view of the same.
" 13. Side view of the last.
" 14. An older Nemertean which probably developed from the last.
" 14^{a}. Proboscis, seen from below.
" 14^{b}. The same, from one side.
" 15. Critical stage in the metamorphosis from the original larva.
" 16. Youngest *Tornaria* found at Newport.
" 17. Still more mature *Tornaria*, also from Newport.

PLATE VI.

Aricidea, Nereis, and Unknown Genera.

m.	Mouth.
ms.	Mandibles.
mt.	Median tentacle.
œ.	Œsophagus.
pr.	Ring-shaped pigment regions on ventral side of body.
q.	Two ventral pigment spots on fourth body segment.
r.	Dorsal pigment bands.

Fig. 1. Larva of *Aricidea* (dorsal view).
" 2. Unknown Annelid larva with two ventral pigment spots.
" 3. The same, slightly older.
" 4. The same, older (Figs. 2, 3, 4, ventral view).
" 4^{a}. Side view of Fig. 2, showing the prominence (*g*) upon which the ventral pigment spot is borne.
" 4^{b}. Side view of ventral prominence in Fig. 4.
" 5. Unknown pelagic worm larva.
" 6. Larva of *Nereis*.
" 6^{a}. Head and jaws of the last.
" 7. Larval Annelid with pigmented ventral rings, described in the text as polytrochal larva (ventral view).
" 8. The same, dorsal view.
" 9. The same, lateral view (head represented downward).
" 10. Larva of *Aricidea* more advanced than that shown in Fig. 1.

PLATE VII.

Lumbriconereis.

ap.	Anterior pole.
ar.	Anterior body region.
cb.	Ciliated band.
cp.	Caudal pigment spots.
i.	Intestine.
j.	Jaws.
lo.	Lateral ocelli.
lp.	Lateral pigment spots.
m.	Mouth.
ma.	Macromeres.
mi.	Micromeres.
nc.	Ventral nerve cells.
œ.	Œsophagus.
pp.	Posterior pigment spots which ultimately become the caudal pigment spots, *cp.*
s.	Stomach.
z.	Unknown organ developed from stomach.

Fig. 1. Egg of *Lumbriconereis*, in which the micromeres have almost wholly surrounded the macromeres.
" 2. Larva of *Lumbriconereis*, in which the anterior prominence (*a p*), the ciliated band, and the external layer have formed. The large macromere cells are to be seen in the middle of the larva through its walls.
" 3. Still older larva of the same, more elongated, and with the anterior prominence pointing to one side.
" 4. Larva of *Lumbriconereis*, in which the internal large cells are less distinct, and in which cephalic and caudal ocelli have appeared.
" 5. The same larva, a little older, in which lateral pigment spots, as well as those mentioned in the preceding figure, are seen.
" 6. A larva still older, the caudal segment of which has begun to lengthen into the future body of the worm.

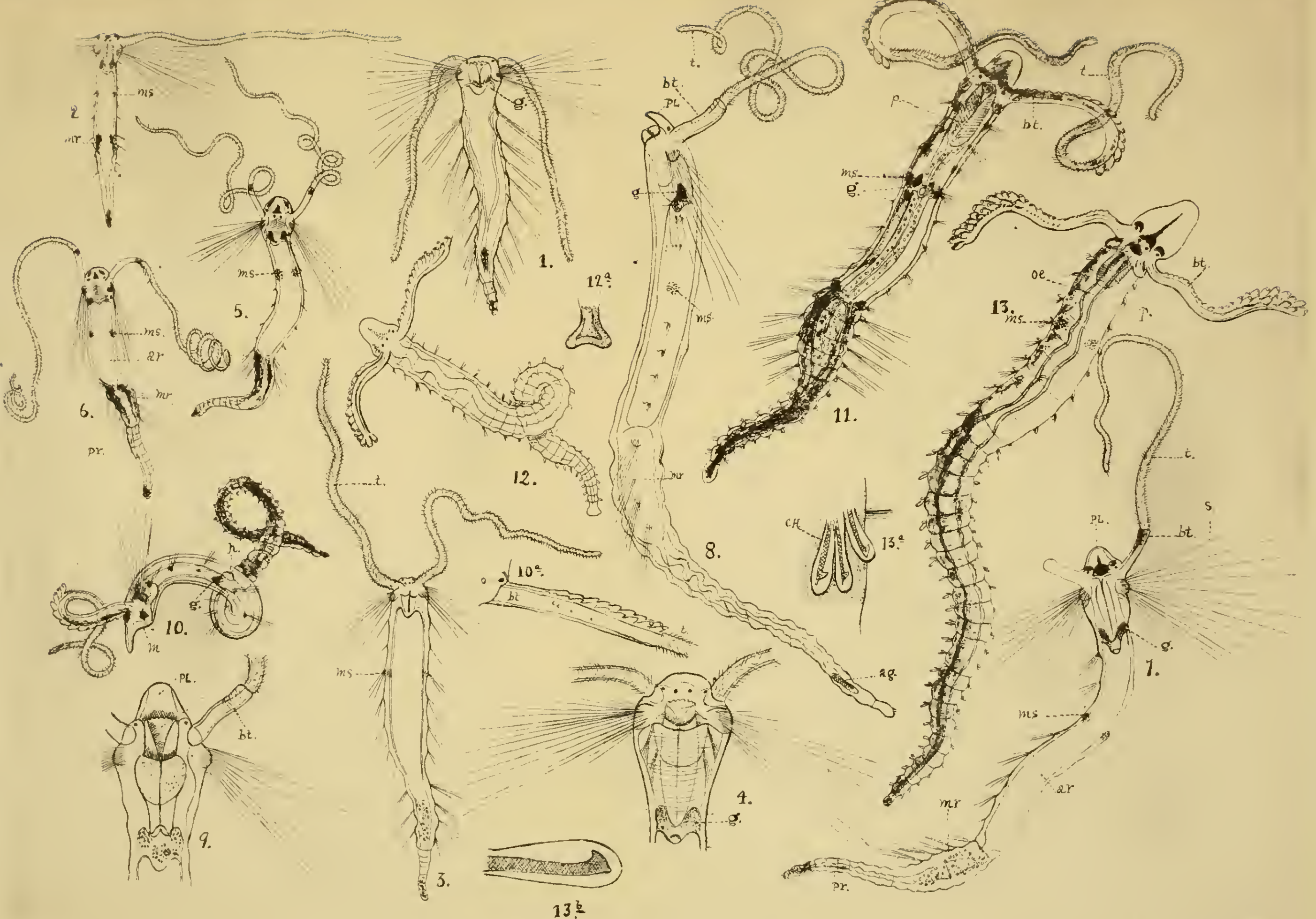
Fig. 7. Larva of *Lumbriconereis*, showing the formation of the mouth and first body segment (1) below the ciliated band. The two clusters of cells above the upper border of the same, near the medial line, are the beginnings of cephalic ganglia. (Ventral view.)
" 7^{a}. Lateral view of a larva a little younger than the last.
" 8. Larval *Lumbriconereis* older than that shown in Fig. 7.
" 9. Still more mature larva of the same, with the rudiments of a second (2) and third (3) body segment.
" 10. The same larva still more mature.
" 11. Larva with three well-defined parapodia and rudiments of two segments posterior to the last.
" 12. A more mature larva with extended setæ and well-developed jaws.
" 13. The oldest form of the larval series referred to *Lumbriconereis* possessing seven pairs of setæ, the most anterior of which are doubled, while the immature forms of new spines can be seen in the more posterior segments.

PLATE VIII.

Lumbriconereis, Nectonema, and Unknown Genus.

a. Anus.
c p. Ciliated pits on the sides of the head.
i s. Immature setæ at the base of those already formed in the body walls.
l. Lateral lines.
l j. Lower jaw.
s g. Division between two segments.
u j. Upper jaw.
w. Segmental orifice.
w b. Body walls.
1, 2, 3, 4, in Fig. 3^{a}, articulations which together form the lower jaw. Of these No. 1 is anterior.

Fig. 1. Setæ and muscular attachments of the same in *Lumbriconereis* larva. (The spine is represented as retracted.)
" 2. The same, extended.
" 3. Larval *Lumbriconereis* with three parapodia.
" 4–10. *Nectonema agilis* Verr.
" 4. The adult *Nectonema*.
" 5. Enlarged view of the head of the same.
" 6. The head from dorsal side.
" 7. Clear space with contained cells (ova ?) in the head.
" 8. The same from dorsal side.
" 9. Magnified view of a section of the lateral line, destitute of lateral spines and "connecting web." These last structures were not found in this specimen.
" 10. Posterior end of the body (♀ ?).
" 11. *Cephalotrix linearis* (young).
" 12–14. Three larval stages in the development of a mesotrochal Annelid, probably *Telepsavus* or *Phyllochætopterus*. (Younger than those figured in Pl. III. See text.)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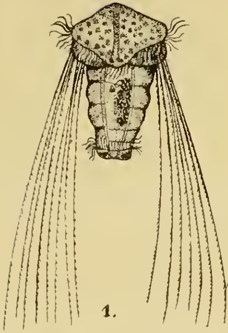
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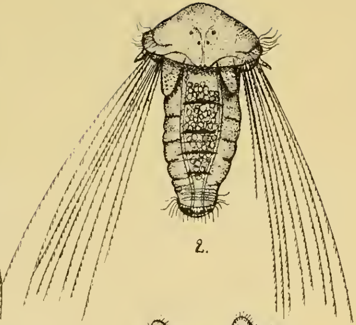
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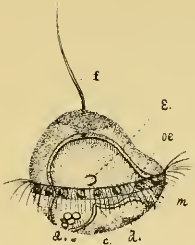

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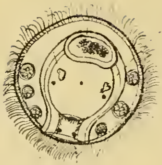

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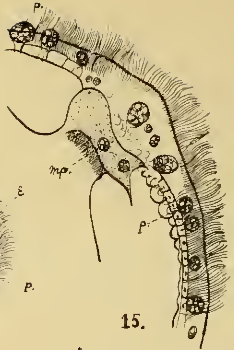

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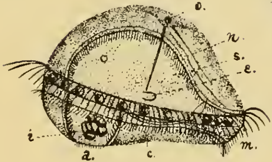

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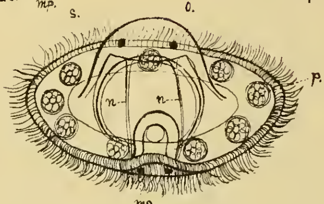

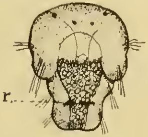

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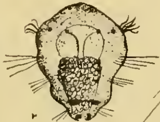

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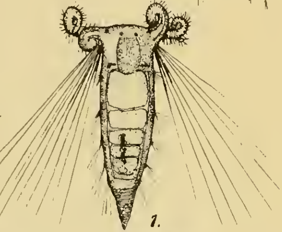
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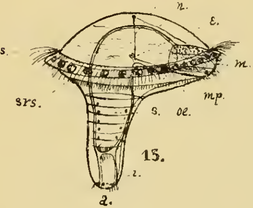
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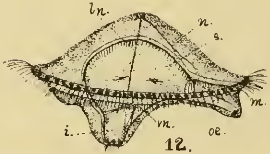
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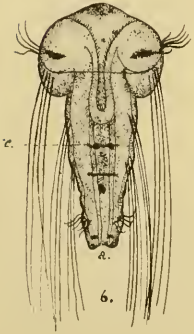

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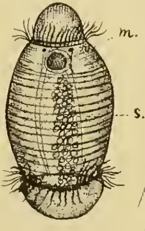

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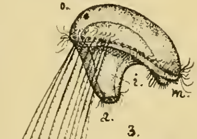

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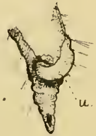

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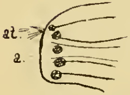

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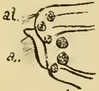

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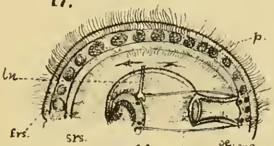
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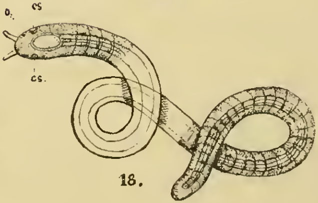

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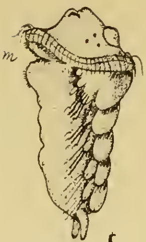

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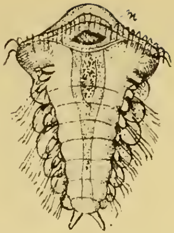

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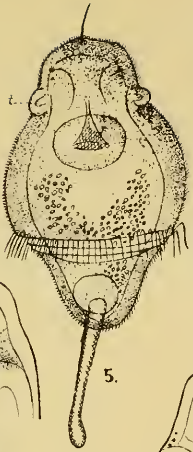

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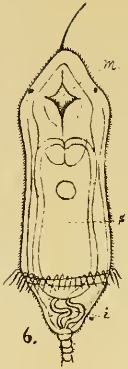

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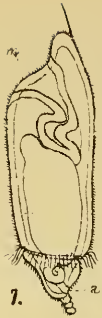

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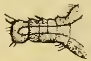

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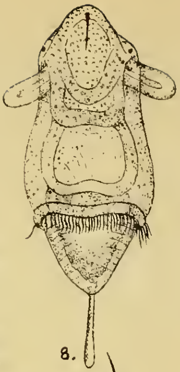

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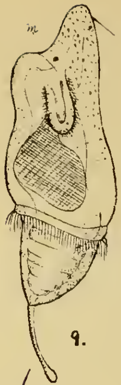

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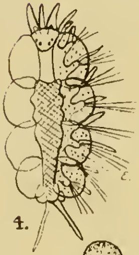

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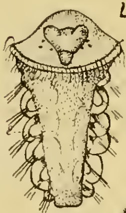

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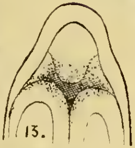

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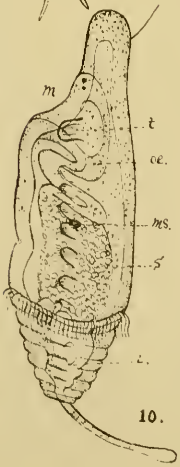

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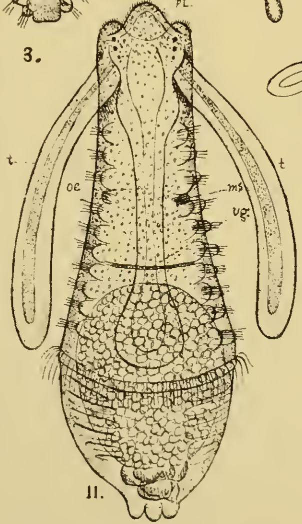

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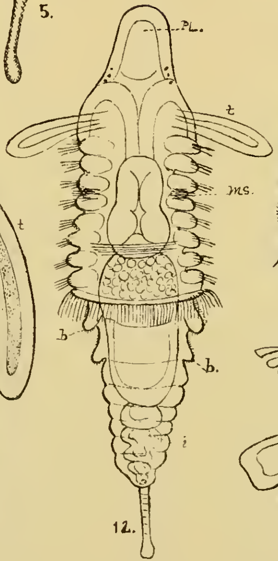

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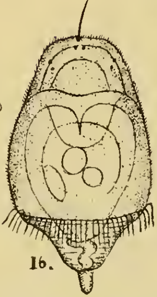

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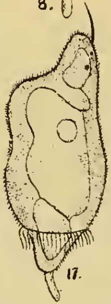

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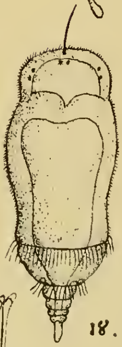

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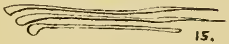

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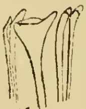

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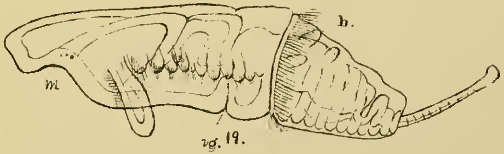

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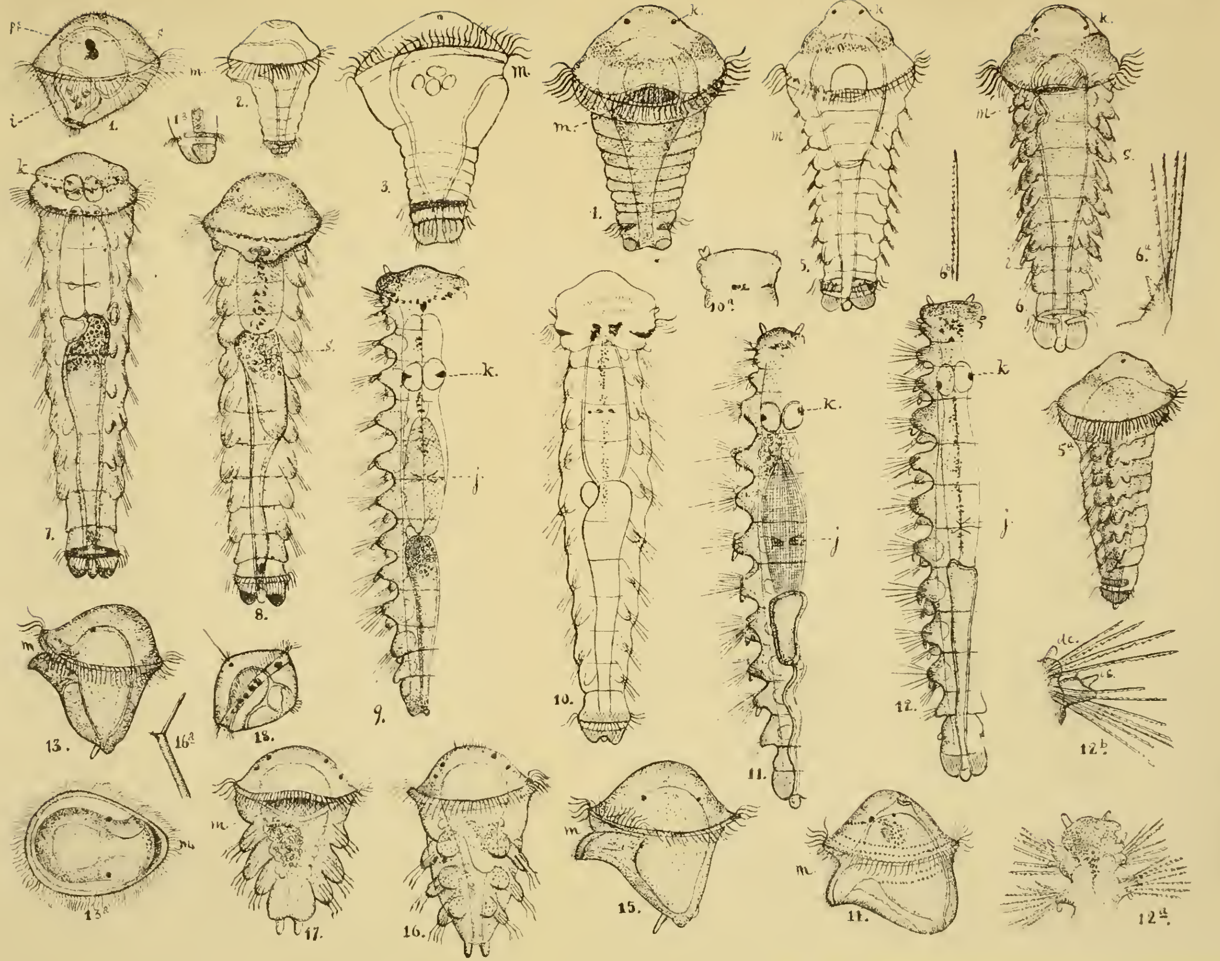
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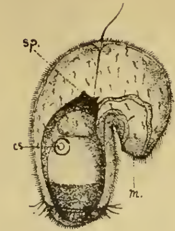

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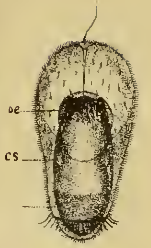

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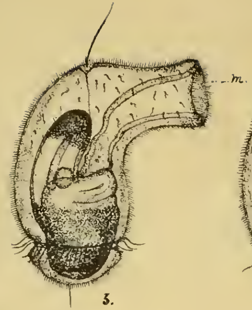

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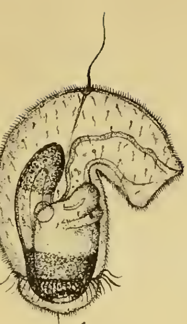

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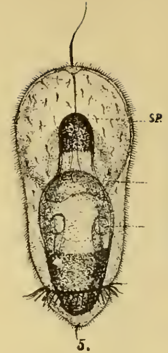

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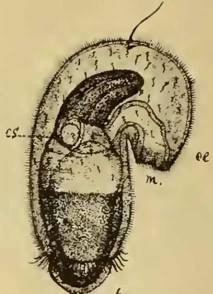

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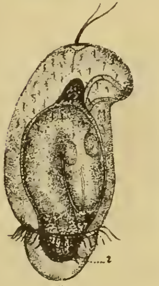

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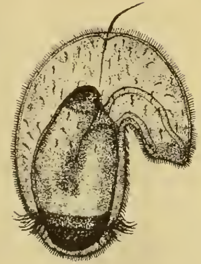

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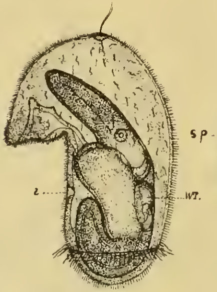

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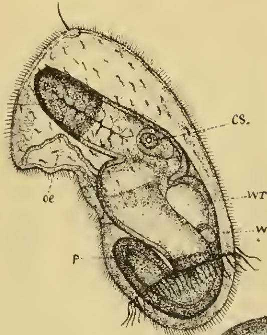

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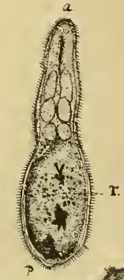

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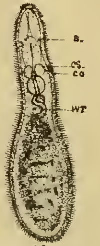

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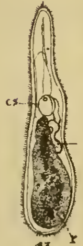

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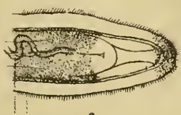

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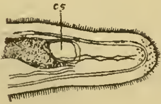

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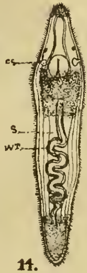

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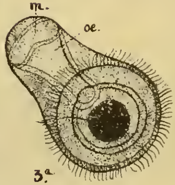

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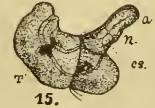

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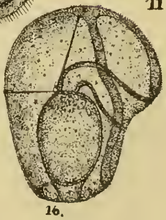

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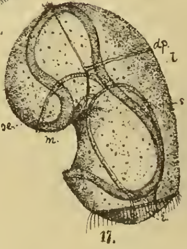

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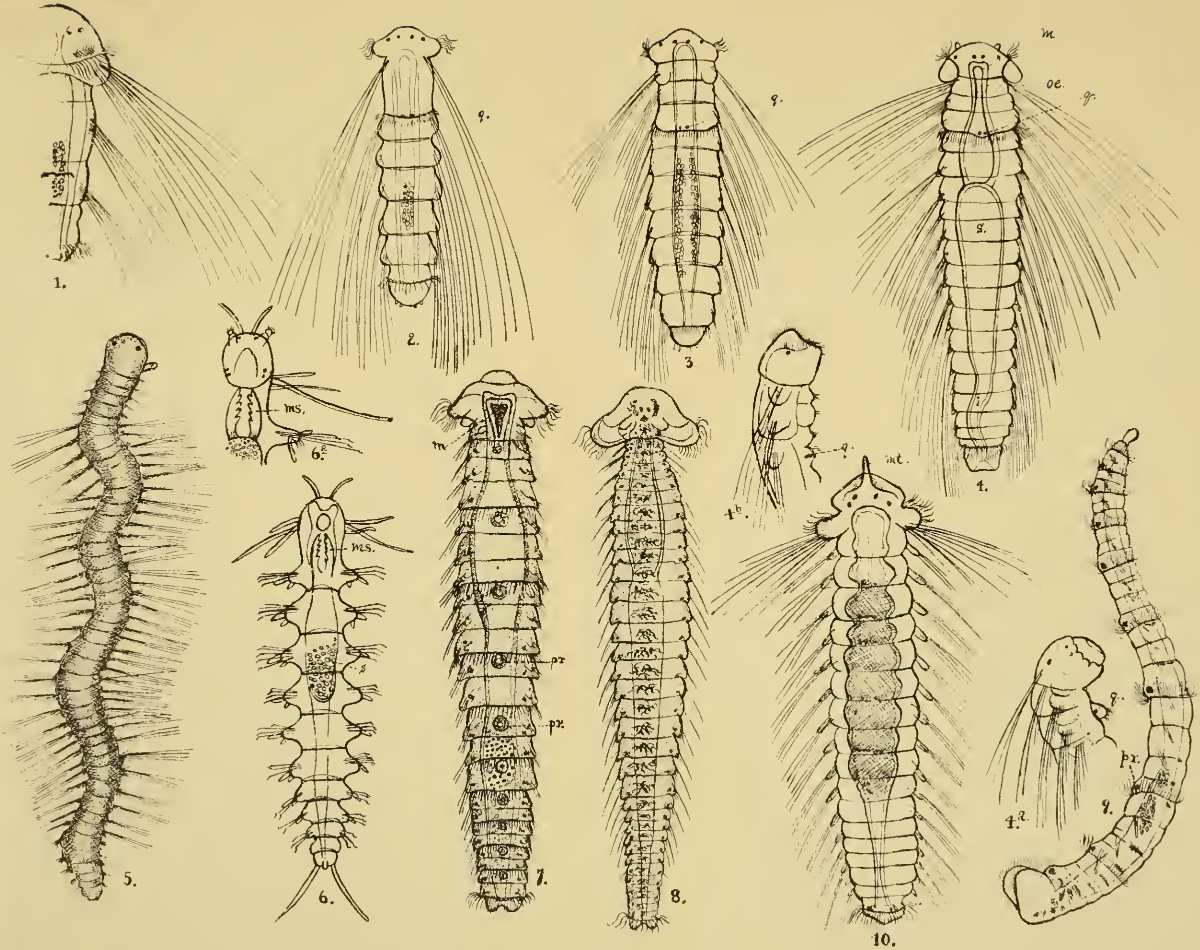
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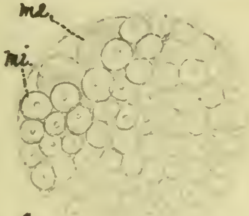
FEWKES, WORM LARVÆ.

PL. VII.



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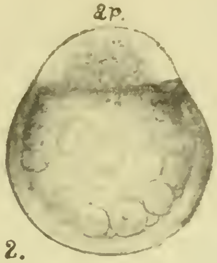

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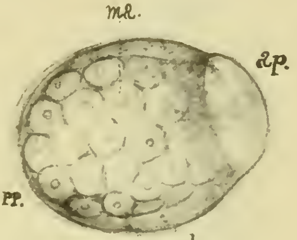

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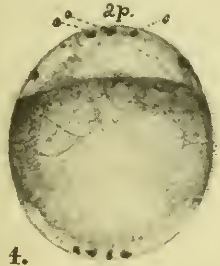

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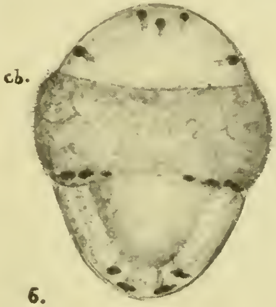

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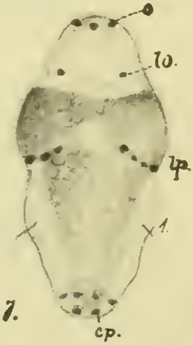

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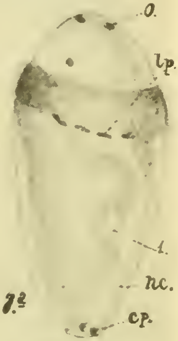

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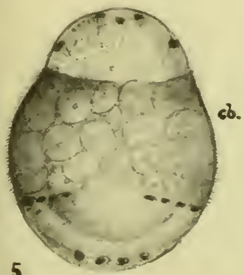

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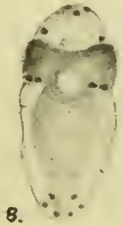

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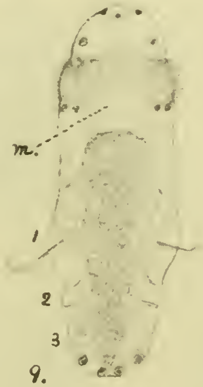

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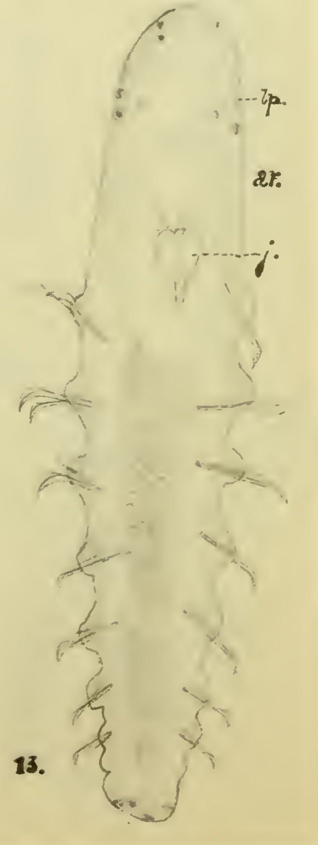

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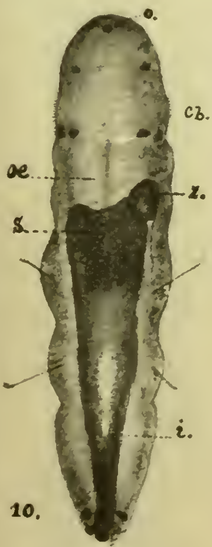

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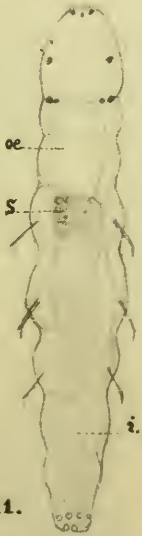

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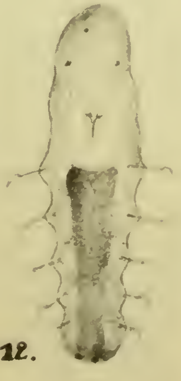

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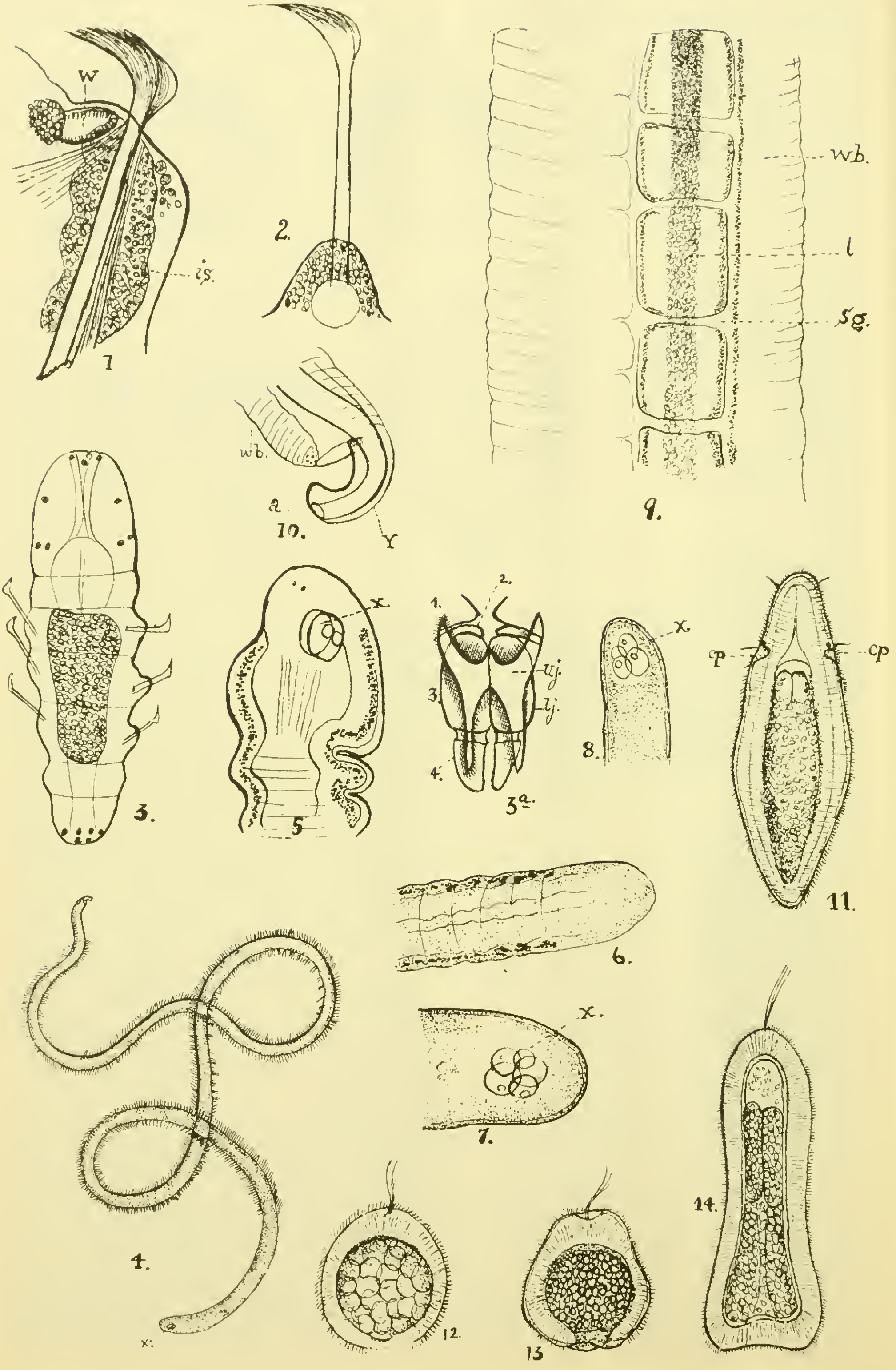
FEWKES: WORM LARVÆ. PL. VII.



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No. 10. — *Bibliography to accompany "Selections from Embryological Monographs, compiled by* ALEXANDER AGASSIZ, WALTER FAXON, *and* E. L. MARK."

III.*

ACALEPHS.

BY J. WALTER FEWKES.

THE most significant of the early contributions to the embryology of the Acraspeda was the recognition by Sars (M.), in 1853, that the sessile genus *Scyphistoma* Sars, and the free medusa, *Ephyra* Eschscholtz, are larval stages of *Aurelia aurita*. The importance of this discovery was much enlarged by Steenstrup (Joh. J.), who pointed out in 1842 that it was an example of "alternation of generations," similar to that described by Chamisso in *Salpa*. The development of genera of Acraspeda without a fixed larval stage was first described by Krohn (A.) in 1855. A similar direct development has been discovered by Haeckel (E.) in *Aurelia*. Important observations on the development of different genera of Acraspeda have been published by Agassiz (L.), Clark (H. J.), and Claus (C.).

The segmentation and peculiar delamination of the ovum of the Trachymedusæ have been studied by Fol (H.) and Haeckel (E.). The larval forms of the same, more especially of the commensal genus *Cunina*, have been investigated by Gegenbaur (C.), Haeckel (E.), McCrady (J.), Müller (F.), Schultze (F. E.), and Uljanin (B.).

Dalyell recognized the "planula" among the Hydroida. The production of the free medusa known as the gonophore from the fixed hydroid by an asexual method of gemmation was traced by Dujardin (F.) in 1848. The knowledge of a wide distribution of this phenomenon among other genera, and its identity with the method of growth called "alternation of generations," we owe to the researches of Agassiz (A.), Agassiz (L.), Allman (G. R.), Claus (C.), Gegenbaur (C.), McCrady (J.), and others. Kleinenberg's account of the embryology of *Hydra* is the best existing of this remarkable genus.

The Discoidea (*Velellidæ* and *Porpitidæ*) have engaged the attention of many embryologists, among whom are Agassiz (A.), Huxley (T. H.), Kölliker (A.), Pagenstecher (H. A.), Stuart (A.), and Vogt (C.). Gegenbaur (C.) first followed the segmentation of the egg and the early larval stages of *Diphyes*, and Leuckart (R.)

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* I. Crustacea. By WALTER FAXON. *Bull. Mus. Comp. Zoöl.*, IX. 6, p. 197. March, 1882. II. Echinodermata. By ALEXANDER AGASSIZ. *Ibid.*, X. 2, p. 109. August, 1882.

This bibliography extends to the year 1883 inclusive. Simple descriptions of new hydroids, which add nothing to a knowledge of embryology, are omitted. An asterisk [*] before a title denotes that the work has not been seen by the compiler.

discovered the connection between monogastric (*Eudoxia*) and digastric (*Abyla*) Calycophores. The other most important contributions to the embryology of the Siphonophora are by Agassiz (A.), Chun (C.), Claus (C.), Haeckel (E.), and Metschnikoff (E.).

The embryology of the Ctenophora has been followed by Agassiz (A.), Chun (C.), Fol (H.), Kowalevsky (A.), and Metschnikoff (E.).

CAMBRIDGE, June 1, 1884.

Agassiz, Alexander.

[Development of *Nanomia cara.*] *Proc. Boston Soc. Nat. Hist.*, IX. p. 181. *1862–63.*

[Young of Medusa of *Halopsis ocellata.*] *Proc. Boston Soc. Nat. Hist.*, IX. pp. 219, 220. *1862–63.*

On the Mode of Development of the Marginal Tentacles of the Free Medusæ of some Hydroids. *Proc. Boston Soc. Nat. Hist.*, IX. pp. 88–101. *1862-63.*

North American Acalephæ. *Ill. Cat. Mus. Comp. Zoöl. at Harvard College*, No. 2. Cambridge, U. S. *1865.*

(Development *passim.*)

Embryology of the Ctenophoræ. *Mem. Amer. Acad. Arts & Sci*, X., No. III. (Separate, in advance.) pp. 357–398, pls. 5. Cambridge, Mass. *1874.*

(*Idyia roseola, Pleurobrachia rhododactyla, Bolina alata, Mertensia ovum.*)

Haeckel's Theory (Allœogenesis) of the Genetic Connection between the Geryonidæ and Æginidæ. *Amer. Journ. Arts and Sci.*, May, *1876. Ann. Mag. Nat. Hist.* [4], XVII. p. 481. *1876.*

(Critical notice of Haeckel's Theory in Beiträge zur Naturgeschichte der Hydromedusen.)

Exploration of the Surface Fauna of the Gulf Stream under the Auspices of the (U. S.) Coast Survey. By ALEXANDER AGASSIZ. III. Pt. I. The Porpitidæ and Velellidæ. *Mem. Mus. Comp. Zoöl.*, VIII. No. 2, pp. 1–16. *1883.*

(Younger stages of *Velella* and *Porpita*; *Chrysomitræ* of both; *Rataria* described by Pagenstecher corresponds with young stages of *Porpita.*)

Agassiz, E. C. and A.

Seaside Studies in Natural History. Marine Animals of Massachusetts Bay. Radiates. pp. 157, figs. 185. Boston, *1865* and *1871.*

(pp. 21-90 larval stages, *passim.*)

Agassiz, Louis.

Twelve Lectures on Comparative Embryology, delivered before the Lowell Institute in Boston, December and January, 1848–49. pp. 104. Boston, *1849.* (Originally published in the *Boston Traveller*, December 22, *1848.*)

(Development *passim.*)

Contributions to the Natural History of the Acalephæ of North America. Pt. I. On the Naked-eyed Medusæ of the Shores of Massachusetts, in their Perfect State of Development. *Mem. Amer. Acad. Arts & Sci.*, IV. Pt. I. pp. 221–316, pls. 8. *1850.*

Contributions to the Natural History of the Acalephæ of North America. Pt. II. On the Beroid Medusæ of the Shores of Massachusetts, in their Perfect State of Development. *Mem. Amer. Acad. Arts & Sci.*, IV. Pt. II. pp. 313–374, pls. 8. *1850.*

(Correspondence of the ciliated lobes of *Pluteus* and ambulacral rows of flappers of *Pleurobrachia* and *Bolina.*

Contributions to the Natural History of the United States of America. III. pp. i.–xi., 1–301, (1)–(26), pls. I.–XIX. IV. pp. i.–viii., 1–380, (1)–(12), pls. I.–XXXV. Boston, *1860, 1862.*

(*Aurelia flavidula*, *Cyanea arctica*, *Pelagia cyanella*, *Coryne mirabilis*, *Clava leptostyla*, *Eudendrium dispar*, *Parypha crocea*, *Tubularia*, *Thamnocnidia*, *Hydractinia*, *Laomedea*, *Millepora*, larval stages of other Acalephs, *passim.*)

Review of Agassiz's Contributions to the Natural History of the United States of America. By J. R. GREENE. *Nat. Hist. Rev.*, I. pp. 433–444. III. pp. 344–359, 479–497. *1861, 1863.*

Homologies of Radiata. *Proc. Boston Soc. Nat. Hist.*, VIII. pp. 226–232. *1862.*

(Comparison of young Acaleph, Polyp and Echinoderm, *passim.*)

Methods of Study in Natural History. pp. i.–vi., 1–319. Boston, *1863.*

(Development *passim.*)

Alder, Joshua.

Catalogue of the Zoöphytes of Northumberland and Durham. *Trans. Tyneside Nat. Field Club*, III. pp. 93–160, pls. III.–X. V. pp. 225–247, pls. VIII.–XI. Newcastle-upon-Tyne. *1854–58, 1860–62.*

(Describes hydroids.)

A Notice of some New Genera and Species of British Zoöphytes. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 90, 91. London, *1857.*

(Describes hydroids.)

Descriptions of three new Species of Sertularian Zoöphytes. *Ann. Mag. Nat. Hist.* [3], III. pp. 353–356, pls. XII.–XIV. *1859.*

(Young of *Plumularia halecioides* resembles *Halecium.* Young of *Halecium labrosum* is parasitic.)

Report on the Zoöphytes. 1862. *Trans. Tyneside Nat. Field Club*, V. pp. 288–290. Newcastle-upon-Tyne. *1860–62.*

(Describes hydroids.)

Descriptions of some new and rare Zoöphytes found on the Coast of Northumberland. *Ann. Mag. Nat. Hist.* [3], IX. pp. 311–317, pls. XIII.–XV. *1862.*

(Development *passim*, hydroids.)

Allman, George J.

On the Universality of a Medusoid Structure in the Reproductive Gemmæ of the Tubularian and Sertularian Polypes. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 70, 71. *1852.*

On the Anatomy and Physiology of Cordylophora, a Contribution to our Knowledge of the Tubularian Zoöphytes. *Phil. Trans. Roy. Soc. London*, pp. 367–384. *1853.*

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On the Structure of the Reproductive Organs in certain Hydroid Polyps. *Edinburgh New Philos. Journ.*, VII. pp. 294–303. *1858.*

Notes on the Hydroid Zoöphytes. *Ann. Mag. Nat. Hist.* [3], IV. pp. 137–144. *1859.*

(Medusa of *Coryne eximia*, nov. sp. described.)

On *Laomedea tenuis*, n. sp. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, p. 143. *1859.*

On the Reproductive Organs of *Sertularia tamarisca*. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 119, 120. *1859.* *Ann. Mag. Nat. Hist.* [3], III. pp. 238–240. *1859.*

On the Structure of the Lucernariadæ. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, p. 143. *1859.*

On some new British *Tubularidæ*. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 101–103. *1862.*

On the Generative Zoöid of *Clavatella*. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, p. 100. *1862.*

On the Structure of *Corymorpha nutans*. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, p. 101. *1862.*

Contributions to our Knowledge of the Structure and Development of the *Beroidæ*. *Proc. Roy. Soc. Edinburgh*, IV. pp. 519–524. *1862.* *Edinburgh New Phil. Journ.*, XV. pp. 285–289. *1862.*

(*Beroë*, ovum forms two layers, development of tubes.)

Report on the Present State of our Knowledge of the Reproductive System in the Hydroida. *Rep. Brit. Assoc. Adv. Sci.*, pp. 351–426. *1863.*

Notes on the Hydroida. *Ann. Mag. Nat. Hist.* [3], XI. pp. 1–12, pl. II. *1863.*

(Describes medusa of *Corymorpha nutans*.)

Notes on the Hydroida. *Ann. Mag. Nat. Hist.* [3], XIV. pp. 57–64, pl. II. *1864.*

(Medusa of *Perigonimus vestitus* and *Zanclea implexa*.)

On the Construction and Limitation of Genera among the Hydroida. *Ann. Mag. Nat. Hist.* [3], XIII. pp. 345–380. *1864.*

(Changes in the medusa form of *Campaniclava* All., *Zanclea*, *Perigonimus*, *Bougainvillia*, *Corymorpha*.)

Notes on the Structure of certain Hydroid Medusæ. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 77–79. *1867.*

(*Slabberia*, *Obelia*, and medusa of *Campanularia.*)

On the Structure of *Coppinia arcta.* *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 87, 88. *1868.*

The Genetic Succession of Zoöids in the Hydroida. *Trans. Roy. Soc. Edinburgh*, XXVI. pp. 97–106, figs. 9. Read May, 1870. Pub. *1872.* Abstr. *Proc. Roy. Soc. Edinburgh.* VII. p. 68.

On the Homological Relations of the Cœlenterata. *Trans. Roy. Soc. Edinburgh*, XXVI. pp. 459–466, figs. 13. Read May, 1870. Pub. *1872.* Abstr. *Proc. Roy. Soc. Edinburgh*, VII. pp. 512, 513.

A Monograph of the Gymnoblastic or Tubularian Hydroids. London, *1871–72.* *Ray Society.* *1869–70.* pp. xxiv. + 50, pls. 23.

(Development, *passim.*)

On the Structure and Development of *Myriothela.* *Phil. Trans. Roy. Soc.*, Vol. CLXV., Pt. II. *1875.*

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II. Larval Forms; their Nature, Origin, and Affinities. *Quart. Journ. Micr. Sci.*, XX. pp. 381–407, figs. 21. *1880.*

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(Young stages of Medusæ, *passim.*)

Monographie der Medusen. 2. Th. 1. Hälfte. Die Tiefsee Medusen der Challenger Reise. 2. Hälfte. Der Organismus der Medusen. pp. 1–205, pls. I.–XII. Taf. 32, also cuts in text. Jena, *1881.*

(Young Medusæ, *passim.*)

Directe und indirecte Entwickelung von *Aurelia aurita*. *Jenaische Zeitschr. f. Naturwissensch.* 15 Bd. 4 Hft. *Sitzungsber.*, pp. 14–15.

(Aurelia with direct development.)

Metagenesis und Hypogenesis von *Aurelia aurita.* Ein Beitrag zur Entwicklungsgeschichte und Taratologie der Medusen. Jena, *1881.*

Hamann, O.

Der Organismus der Hydroidpolypen. *Jenaische Zeitschr.*, XV. pp. 473–544.
(Planula always formed by delamination.)

Zur Entstehung und Entwickelung der grünen Zellen bei *Hydra. Zeitsch. f. wissensch. Zool.*, XXXVII. pp. 457–464, pl. XXVI.

Hertwig, O. and R.

Der Organismus der Medusen und seine Stellung zum Keimblättertheorie. pp. 1–70, pls. I.–III. Jena, *1878.*

Hincks, T.

Notes on the Reproduction of *Campanulariadæ;* with a Description of a new Species of *Laomedea. Ann. Mag. Nat. Hist.* [2], X. pp. 81–87, pls. 3. *1852.*

Notes on British Zoöphytes, with Descriptions of new Species. *Ann. Mag. Nat. Hist.* [2], XV. pp. 127–130, pls. I., II. *1855.*
(Describes hydroids.)

On a new Species of *Laomedea;* with Remarks on the Genera *Campanularia* and *Laomedea. Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, p. 126. *1858.*

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On the Production of similar Gonozooids by Hydroid Polypes belonging to different Genera. *Ann. Mag. Nat. Hist.* [3], X. pp. 459–461, pl. IX. *1862.*

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Hoeven, J. van der.

Handbuch der Zoologie. *See* LEUCKART, R.

Huxley, T. H.

Observations upon the Anatomy of the *Diphyidæ* and the Unity of Organization of the *Diphyidæ* and *Physophoridæ*. *Proc. Linn. Soc. London*, II. pp. 15, 60, 65, 67–69. *1848–55.*

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An Account of Researches into the Anatomy of the Hydrostatic Acalephæ. *Rep Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 78–80. *1851.*

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(Development, *passim.*)

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Trans. by J. W. SPENGEL.

(Development, *passim.*)

Jäger, G.

Ueber das spontane Zerfallen der Süsswasserpolypen nebst einigen Bemerkungen über Generationswechsel. *Sitzungsb. Akad. Wissensch. Wien, Math. Naturw. Classe*, XXXIX. pp. 321–340, pl. I. *1860.* *Ann. Sci. Nat.* [4], XII. p. 306. *1859.*

Johnston, G.

A History of British Zoöphytes. Edinburgh. *1st Edition, *1838.* 2d Edition, *1847.* pp. i.–ix. + 1–341, pls. 44.

(Development, *passim.*)

Jung, H.

Beobachturgen über die Entwicklung des Tentakel-kranzes von *Hydra.* *Morph. Jahr. Ber.*, VIII. pp. 339–350. *1883.*

(No fixed law of development of tentacles in different species.)

Keferstein, W.

Untersuchungen über niedere Seethiere. I. Ueber die Gattung *Lucernaria*, O. F. Müller. pp. 1–26, pl. I. II. Ueber einige Quallen. pp. 26–31, pls. I., II., figs. 1–14. *1862.* *Zeitschr. f. wissensch. Zool.*, XII. pp. 1–147. *1863.*

(Budding (*Eucope?*) *gemmifera*, pp. 28, 29.)

Keferstein, W., and Ehlers, E.

Auszug aus den Beobachtungen über die Siphonophoren von Neapel und Messina angestellt im Winter 1859–60, p. 260. *Nach. Ges. Wiss. Göttingen*, No. 23, pp. 254–262. *1860.* *Arch. f. Naturgesch.*, I. pp. 324–331. *1860.*

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I. Beobachtungen über die Siphonophoren von Neapel und Messina. pp. 1–34, pls. I.–V. V. Ueber einige in Neapel und Messina beobachtete Quallen. pp. 78–95, pls. XIII.–XIV.

Kirchenpauer, (Senator).

Die Seetonnen der Elbmündung. Ein Beitrag zur Thier und Pflanzentopographie. 1862. *Abhandl. Naturw. Verein, Hamburg*, IV. Pt. 3, pp. 59. *1858–1862.*

(Development of *Laomedea*, pp. 20–23.)

Kleinenberg, N.

Hydra, eine anatomisch-entwicklungsgeschichtliche Untersuchung. pp. 90, pls. 4. Leipzig, *1872.*

Koch, G. von.

Vorläufige Mittheilung über Cölenteraten. *Jenaische Zeitschr.*, VII. pp. 464–470, (Continuation) 512–515, pls. XXIII., XXVI. *1873.*

(Development of *Tubularia*, and origin of egg in Cœlenterates.)

Kölliker, A.

Bericht über einige im Herbste 1852 in Messina angestellte vorgleichend-anatomische Untersuchungen von Gegenbaur, Kölliker und H. Müller. II. Ueber Quallen. pp. 315–329. Scheibenquallen. *Zeitschr. f. wissensch. Zool.*, IV. pp. 299–370. *1853.*

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(Development, *passim.*)

See **Gegenbaur, C., Kolliker, A., and Müller, H.**

Koren, J., and Danielssen, D. C.

Fauna Littoralis Norvegiæ. Pt. 3. pp. 163, pls. 16. Bergen, *1877.*

Korotneff, A.

Entwickelung der *Myriothela*. *Zool. Anzeig.*, II. pp. 187–190. *1879.*

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Abstr. Development of *Hydra*. *Journ. R. Micros. Soc.*, III. Pt. 4, pp. 514, 515.

Korthals, P. W.

Over de Oorzaak van het Branden der *Physalia*. 1837. *Tijdschr. voor Natuurl. Geschied en Physiol.*, IV. pp. 209–210. *1837–38.* *Froriep's. Neue Notizen*, VI. No. 112.

Kowalevsky, A.

Entwicklungsgeschichte der Rippenquallen. 1866. *Mém. Acad. Imp. Sci. St. Pétersbourg*, X. No. 4 [7], pp. viii. + 28, pls. 5. *1867.*

(*Eschscholtzia*, *Cestum*, *Eucharis*, *Beroë*.)

Untersuchungen über die Entwickelung der Cœlenteraten. Vorläufige Mittheilung. *Nachr. Gesellsch. Wissensch. Göttingen*, pp. 154–159. *1868.*

НАБЛЮДНІЯ НАДЬ РАЗВИТІЕМЪ. CŒLENTERATA. ИЗВѢСТІЯ ИМПЕРАТОРСКАГО ОБШЕСТВА ЛЮБИТЕЛЕИ ЕСТЕСТВОЗН АНІЯ ТОМЪ X ВЫЩУСКЪ2-Й.

(Development of *Eucope*, *Pelagıa*, and Ctenophores).

Untersuchungen über die Entwicklung der Cœlenteraten. *Nach. k. Gesellsch. Freunde Naturw. Anthr. Ethn. Univ. Compt. Rendus*, X. pt. 2, pp. 36, pls. 8. *1872–73.* Moskau, *1874.* *Jahresb. Anat. Phys.*, II. pp. 279–283. *1873.*

Krohn, A.

Ueber die Brut des *Cladonema radiatum* und deren Entwickelung zum *Stauridium*. *Arch. Anat. Physiol. wissensch. Med.*, pp. 420–426, pl. XIII. *1853.*

Ueber die frühesten Entwickelungsstufen der *Pelagia noctiluca*. *Arch. Anat. Physiol. wissensch. Med.*, pp. 491–497, pl. XX. *1855.*

Beobachtungen über den Bau und die Fortpflanzung der *Eleutheria* Quatref. *Arch. f. Naturgesch.*, pp. 157–170. *1861.*

Trans. by W. S. Dallas. Observations on the Structure and Reproduction of *Eleutheria* Quatref. *Ann. Mag. Nat. Hist.* [3], IX. pp. 1–9. *1862.*

Lacaze-Duthiers, H.

Embryogénie des Rayonnés. Reproduction généagénitique des Porpites. Extrait d'une Lettre addressée à M. de Quatrefages. *Comptes Rendus*, LIII. pp. 851–853. *1861.* *Rev. et Mag. Zool.*, XIII. pp. 488–490. *1861.*

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Système des Animaux sans Vertèbres. Paris, *1801.*

Histoire Naturelle des Animaux sans Vertèbres. 1st Edit. II. Paris, *1816.*

Histoire Naturelle des Animaux sans Vertèbres. 2d Edit. II. Paris, *1836.*

(Multiply by budding.)

Lamouroux, J. V. F.

Histoire des Polypiers coralligènes flexibles vulgairement nommés Zoophytes. Caen, *1816.*

Exposition Méthodique des Genres de l'Ordre des Polypiers. Paris, *1821.*

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On *Limnocodium* [*Craspedacustes*] *Sowerbii*. A new Trachomedusa inhabiting Fresh Water. *Quart. Journ. Micr. Sci.*, XX. pp. 351–371, pls. XXX., XXXI. *1880.*

On Young Stages of *Limnocodium* and *Geryonia*. *Quart. Journ. Micr. Sci.*, XXI. pp. 194–201, pl. XIII., and figs. *1882*.

Leidy, J.

Contributions towards a Knowledge of the Marine Invertebrate Fauna of the Coasts of Rhode Island and New Jersey. *Journ. Acad. Nat. Sci. Philadelphia* [2], III. pp. 135–152, pls. X., XI. *1855*.

(*Eucoryne elegans* Leidy, produces medusa-like buds.)

Lesson, R. P.

Mémoire sur la Famille des Béroides [*Beroideæ* Less.]. *Ann. Sci. Nat.* [2], V. pp. 235–266. *1836*.

Histoire Naturelle des Zoophytes Acalèphes. Paris, *1843*. pp. 596, pls. 12. Suites à Buffon.

Leuckart, R.

Nachträge und Berichtigungen zu dem ersten Bande von J. Van der Hoeven's Handbuch der Zoologie. Leipzig, *1856*.

(Separates hydroids with direct development and those with indirect.)

Ueber den Bau der Physalien und Röhrenquallen im Allgemeinen. *Zeitschr. f. wissensch. Zool.*, III. pp. 189–212, pls. I.–VI. *1851*. *Ann. Sci. Nat.* [3], XVIII. pp. 201–230, pl. V. *1852*.

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(Young *Agalma*.)

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(Development, *passim*.)

Zoologische Untersuchungen. Erstes Heft. Siphonophoren. pp. 95, pls. 3. Giessen, *1853*.

(Relation between *Diphyes*, *Abyla*, and *Eudoxia*. Development, *passim*.)

Bericht über die wissenschaftlichen in der Naturgeschichte der niederen Thiere während der Jahre 1859–1879. *Arch. f. Naturgesch.*, 1860, 1861, 1863, 1864, 1866, 1868, 1870, 1872, 1875, 1879.

See **Frey, H., and Leuckart, R.**

Lovén, S. L.

Bidrag till kännedomen af Slägiena *Campanularia* och *Syncoryna*. *Handl. k. Svensk. Vetensk. Akad. Stockholm*, pp. 260–281. *1835*.
Transl. *Arch. f. Naturgesch.*, pp. 249–262, 321-326, pl. VI. *1837*.

(Confirms Ehrenberg's views of the sexual nature of egg-bodies.)

McCrady, J.

Gymnophthalmata of Charleston Harbor. 1857. *Proc. Elliott Soc., Charleston, S. C.*, I. pp. 103–221, pls. VIII.–XII. *1853–58*.

(Commensalist in bell of *Turritopsis* is a *Cunina*.)

Description of *Oceania* [*Turritopsis*] *nutricula* nov. spec., and the Embryological History of a singular Medusan Larva found in the Cavity of its Bell. 1856. *Proc. Elliott Soc., Charleston, S. C.*, I. pp. 55–90, pls. IV.–VII. *1853-58.*

On the Development of two Species of Ctenophora found in Charleston Harbor. 1857. *Proc. Elliott Soc., Charleston, S. C.*, I. pp. 254–271, pl. XIV. *1853–58.*

(Describes tentaculated young.)

Mereschkovsky, C. de.

On an Anomaly among the *Hydromedusæ*, and on their Mode of Nutrition by Means of the Ectoderm. *Ann. Mag. Nat. Hist.* [5], III. pp. 177–181, pl. XX. *1879.*

(Young *Bougainvillea* has no mouth or stomach.)

Développement des Spermatozoides dans la Méduse (*Cassiopea borbonica*). *Arch. Zool. Experiment.*, X. No. 4, pp. 577–582.

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Metschnikoff, E.

Beiträge zur Entwickelungsgeschichte einiger niederen Thiere. Vorläufige Mittheilung 1870. *Bull. Acad. Impér. Sci. St. Pétersbourg*, XV. pp. 502–509. *1871.*

(Larva of *Gleba* (*Hippopodius*).)

Ueber die Entwickelung einiger Cœlenteraten. 1870. *Bull. Acad. Impér. Sci. St. Pétersbourg*, XV. pp. 95–100. *1871.*

Review by R. Leuckart, *Arch. f. Naturgesch.*, pp. 225, 231–233. *1872.*

Studien über die Entwickelung der Medusen und Siphonophoren. *Zeitschr. f. wissensch. Zool.*, XXIV. pp. 15–83, pls. II.–XII. *1874.*

(Young stages of *Cunina*, *Polyxenia*, *Agalma*, *Stephanomia*, *Epibulia*, *Halistemma*, *Praya*, and *Hippopodius*.)

Vergleichend-Embryologische Studien. *Zeitschr. f. wissensch. Zool.*, XXXVI. pp. 433–444, pl. XXVIII. *1881.*

(Early stages of development of *Carmarina fungiformis.*)

Metschnikoff, E., and Ludmila.

МАТЕРІАЛЫКЪ ПОЗНАНІЮ СИФОНОФОРЬ И МДУЗЪ. ИЗВѢСТІЯ ИМПЕРАТОРСКАГО ОБЩЕСТВА ЛЮБИТЕЛЕЙ ЕСТЕСТВОЗНАНІЯ, АНТЯОПОЛОГІИ И ЭТНОГРАФІИ. МОСКВА, *1871.* pp. 1–75, pls. I.–VI.

(Development of Siphonophora and Medusæ.)

Meyen, F. J. F.

Beiträge zur Zoologie, gesammelt auf einer Reise um die Erde. Fünfte Abhandl. Leuchten des Meeres und Beschreibung einiger Polypen und

anderer niederer Thiere. *Nova Acta Acad. Nat. Cur.*, XVI., Suppl. pp. 125–216, pls. XXVII.–XXXVI. Breslau u. Bonn, *1834*.

Meyer, A., and Möbius, K.

Kurzer Ueberblick der in der Kieler Bucht von uns beobachteten wirbellosen Thiere, als Vorläufer einer Fauna derselben. *Arch. f. Naturgesch.*, pp. 229–237. *1862.*

(*Sarsia tubulosa* develops from *Syncoryne*, p. 231.)

Milne Edwards, H.

Lecons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux. I.–XIV. Paris, *1857–1881.*

Möbius, K. *See* **Meyer, A., and Möbius, K.**

Morse, E. S.

Something about Jelly-Fishes. *Amer. Natur.*, pp. 244–253, pl. VIII. *1867.*

(Development of Discophora and Hydroida.)

Müller, F.

Zwei neue Quallen von Santa Catharina [Brasilien] 1858. *Abhandl. Naturf. Gesellsch. Halle,* V. pp. 3–12, pls. 3. *1858–59.*

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Polypen und Quallen von Santa Catharina. *Arch. f. Naturgesch.*, pp. 310–321, pl. XI. *1859.*

(*Glossocodon* and *Cunina.*)

Polypen und Quallen von Santa Catharina, *Olindias sambaquiensis,* n. sp. *Arch. f. Naturgesch.*, pp. 312–319, pl. IX. *1861.*

(Larval form has longer tentacles than adult.)

Ueber die systematische Stellung der Charybdeiden. *Arch. f. Naturgesch.*, pp. 302–311. *1861.* *Ann. Mag. Nat. Hist.* [3], X. pp. 6–12. *1862.*

*Cunina Kölliker*i, n. sp. Beitrag zur Naturgeschichte der Aeginiden. *Arch. f. Naturgesch.*, pp. 42–52, pl. IV. *1861.*

(Development of *Cunina.*)

Ueber die Randbläschen der Hydroidquallen. *Arch. f. Mikr. Anat.*, I. pp. 143–147, pl. VII., fig. 4. *1865.*

Müller, J.

Ueber eine eigenthümliche Meduse des Mittelmeeres und ihren Jugendzustand. *Arch. Anat. Physiol. wissensch. Med.*, pp. 272–277, pl. XI. *1851.*

(Young *Beroë*, direct development.)

Müller, H. *See* **Gegenbaur, C., Kölliker, A., and Müller, H.**

Müller, P. E.

Iagttagelser over nogle Siphonophorer. 1869. *Natur. Tidskr.* [3], VII. pp. 261–332, 541–547, pls. XI.–XIII. Kjöbenhavn, *1870–71.*

(Development of *Eudoxia* and *Diphyes;* describes deformed Spermatozoa direction cells?)

Mummery, J. B.

On the Development of *Tubularia indivisa.* 1852. *Micr. Journ. Trans.,* I. pp. 28–30. *1853.*

Nordmann, Alexander von.

Sur les Changements que l'Âge apporte dans la Manière d'être des Campanulaires. *Comptes Rendus Acad. Sci. Paris,* IX. p. 704. *1839.*

Noshin, N.

Ueber einen Generationswechsel bei *Geryonia proboscidalis* und die Larve von *Rhizostoma. Mél. Biol.,* V. pp 27–33, pl. I. *1865.*

Packard, A. S., Jr.

Life Histories of Animals, including Man, or Outlines of Comparative Embryology. pp. 239, figs. 268, pl. I. New York, *1876.*

(Acalephæ, pp. 56–70, figs. 46–63.)

Pagenstecher, H. A.

Untersuchungen über niedere Seethiere aus Cette. VIII. Zur näheren Kenntniss der Vellelidenform *Rataria,* nebst Betrachtungen über die Velleliden im Allgemeinen. pp. 496–527, pls. XL., XLI. *Zeitschr. f. wissensch. Zool.,* XII. pp. 486–529. *1863.*

Eine neue Entwickelungsweise bei Siphonophoren. *Zeitschr. f. wissensch. Zool.,* XIX. pp. 244–252, pl. XXI. *1869.*

(Young Siphonophore develops in a mantle out of which it is born with provisional organs.)

Allgemeine Zoologie oder Grundgesetze des thierischen Baus und Leben. Berlin, I.–IV. *1875–1881.*

Pallas, P. S.

Elenchus Zoophytorum. Hagæ Comitum. 1766. pp. i.–xvi. + 17–451.

Spicilegia Zoologica. I. Berolini. 1774. Zoophyta Quædam Minuta. Fasc. 10, pp. 34–41.

Peach, C. W.

Notice of a curious Metamorphosis in a Zoöphyte-like Animal. 1856. *Proc. Roy. Phys. Soc. Edinburgh,* I. pp. 59–61, figs. 2. *1854–58. Edinburgh New Philos. Journ.,* IV. pp. 162–164, figs. 2. *1856.*

On the Zoöphytes of Caithness. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.,* p. 155. *1859.*

Perrier, E.

Les Colonies Animales et la Formation des Organismes. pp. xi. + 798, pls. 2, figs. 158. Paris, *1881.*

Philippi, R. A.

Ueber den Bau der Physophoren und eine neue Art derselben [*Physophora tetrasticha*]. *Arch. Anat. Physiol. wissensch. Med.,* pp. 58–67, pl. V. *1843.*

Pillsbury, J. H.

Development of the Planula of *Clava leptostyla*, Ag. *Amer. Monthly Micr. Journ.*, III. pp. 181, 182. *1882.*

Plessis, G. du.

Remarques sur les Metamorphoses de la Cassiopée Bourbonnienne (*Cassiopea borbonica* D. Ch.). *Bull. Soc. Vaud. Sc. Nat.*, XVII. pp. 86, 633–638, pl. XXI.

(Describes Planula, Scyphostoma, Strobila, and Ephyra.)

Observations sur la Cladocoryne flocconeuse (*Cladocoryne floccosa* Rotch). *Mittheil. Zool. Stat. Neapel.*, II. pp. 176–196, pl. IX. *1880–81.*

Price, J.

On the Embryogeny of Pulmogrades and Ciliogrades. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 86, 87. *1846.*

(Development of Ctenophore without "alternation of generations.")

On the Genus *Cydippe*. *Rep. Brit. Assoc. Adv. Sci., Trans. Sect.*, pp. 155, 156. *1859.*

(Young like adult.)

Quatrefages, A. de.

Mémoire sur l'Eleuthérie dichotome [*Eleutheria dichotoma* Nob.] nouveau Genre de Rayonnés, voisin des Hydres. *Ann. Sci. Nat.* [2], XVIII. pp. 270–288, pl. XVIII. *1842.*

Mémoire sur la Synhydre Parasite [*Synhydra parasites* Nob.] nouveau Genre de Polypes voisin des Hydres. *Ann. Sci. Nat.* [2], XX. pp. 230–248, pls. VIII., IX. *1843.*

Mémoire sur l'Organisation des Physalies [*Physalia*]. *Ann. Sci. Nat.* [4], II. pp. 107–142, pls. III., IV. *1854.*

(Sexual buds.)

Ray Lankester. *See* **Lankester, E. Ray.**

Reid, J.

Observations on the Development of the Medusæ. *Ann. Mag. Nat. Hist.* [2], I. pp. 25–34, pls. V., VI. *1848.*

(Scyphostoma and Ephyra of *Aurelia.*)

Sars, Michael.

Fremlagde detaillerede Afbildninger, ledsagede med Bemaerkninger over følgende norske Cœlenterater. 1860. *Forhandl. Vidensk. Selsk. Christiania*, pp. 140–151. *1861.*

Beskrivelser og Iagttagelser over nogle mœrkelige eller nye i Havet ved den Bergenske Kyst levende Dyr af Polypernes, Acalephernes, Radiaternes, Annelidernes og Molluskernes Classer. . . . pp. 81, pls. 15. Bergen, *1835.*

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(*Cytæis* buds from proboscis; Strobila is young Medusa.)

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XV.

On the Development of Agalma. By J. Walter Fewkes.

The genus *Agalma*, in its growth from an egg into the adult, passes through three larval stages which can be readily distinguished from each other. These larvæ, from the nature of the growth of the *Agalma* colony, are not separated from one another by clearly marked distinctions, but temporary organs found in one stage are often carried over to the next in the course of the passage of one larva into that next following. The peculiarities, however, of each are strongly enough defined to justify the division of the embryological history of *Agalma* into the three stages to which reference is made.

These three characteristic larvæ about which the young of the genus *Agalma* group themselves have been given the following names: 1. The primitive larva; 2. The Athorybia stage; 3. The larva like the adult in general features, although possessing together with organs of the adult certain provisional structures bequeathed to it from the earlier conditions of growth through which it has passed.

The last two of these larval stages are not considered in this paper, except incidentally to record observations on certain appendages of the Athorybia stage, showing the fate of organs of permanent and others of provisional nature which play an important part in the appearance ot the youngest or primitive larval condition. The present contribution deals with the outward changes in the growth of the egg from fertilization to the primitive larva. In that epoch many important organs, some of which persist into the adult, originate; and, more significant still, at that time first arise the three layers out of which every organ of the whole colony is developed. The development of the first of the three larval stages of *Agalma* may consequently be looked upon as a key to the phylogeny of the Oceanic Hydrozoa. It is therefore at all events necessary, before we can trace the relationships of different genera widely or closely related to *Agalma*, to know accurately the changes in external form which the ovum passes through in these genera. Upon such knowledge we can hang our speculations regarding the possible descent of the members of the Siphonophora one from another, or from a common ancestor.

The species of *Agalma* which has been studied is the only *Agalma* thus far recorded from New England waters. It is called *Agalma elegans*, and was first described by the author. When this animal was first taken, in 1876, I regarded it as the same as the "form (b)" of *Agalmopsis elegans* Sars, or closely related to it.

Early Changes of the Egg before Segmentation.

The earliest changes in the egg take place, in all cases observed, while it is enclosed in the female gonophore.* These go on with great rapidity, as will be shown by the following statements. Specimens of *Agalma* captured on August 6, at noon, were found four hours later to have dropped their gonophores, from which had come ova segmented in the 4-cell stage. It must be mentioned, however, that by transferring the *Agalma* from the sea into aquaria they were placed in unnatural conditions, so that changes in temperature and other causes may have accelerated or retarded their rate of growth. There is nothing to show that there are not other kinds of segmentation besides that which is here described.

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* In a popular article on the development of *Agalma elegans*, published in the American Naturalist for March, 1881, certain changes in the germinative vesicle which were mistaken for segmentation were spoken of. This interpretation was erroneous, and the true segmentation was not described. On p. 188, *op. cit.*, the egg is spoken of as cast into the water and there impregnated. There is nothing to prove that this is the case in *Agalma*. It has, however, excellent support in the history of observation. Gegenbaur, Beiträge zur näheren Kenntniss der Schwimmpolypen (Siphonophoren), p. 49. Writing of the genera *Agalmopsis*, *Forskalia*, *Physophora*, *Hippopodius*, and *Diphyes*, he says: "Die Befruchtung erfolgt erst nach dem Austritte der Eier aus der Eikapsel; denn niemals fand ich Samenfäden in letzere eingedrungen, eben ausgetretene Eier dagegen stets von ihnen umschwärmt. Sie sassen dann strahlenartig mit dem Köpfchen an der Peripherie des Eies an, mit dem Fadentheile selbst in zitternder Bewegung." I have not been able to observe a similar condition in *Agalma*, nor was a free egg with nucleus and nucleolus found floating in the water. In one instance these bodies were observed to vanish while yet the ovum was in its gonophore, while the stalk of the same was attached to the parent. All eggs found free from the gonophore are destitute of these structures.

Four hours after an *Agalma* was placed in the aquarium, eggs in the 4-cell stage were picked out of the water in which it was confined. I have traced one and the same egg from the 2-cell to the 4-cell stage, and find that it takes 2 h. 10 m. for the necessary changes to be perfected in this growth. On another egg it was determined that it takes 45 m. to develop an egg in the 2-cell stage from an egg in which the germinative vesicle, or "nucleus," had disappeared. By this observation it will be seen that it requires a little over an hour to pass from the egg just fertilized into the stage which exhibits the first sign of a primitive cleavage, plus the interval of time which elapses after the 2-cell stage is formed and before it begins to form the secondary furrow, or origin of the second cleavage-plane. This last interval is probably not more than 30 m.; consequently the interval which elapses after fertilization before the formation of the primary furrow is about half an hour.

Impregnation probably takes place in the gonophore. I have not been able to fecundate the *Agalma* egg artificially, nor was it seen to take place naturally. I have repeatedly tried to fertilize ova with sperm from the same colony, but have always failed. This fact led me, in 1880, to state that the animal cannot be impregnated by spermatozoa from its own male bells. Last summer (1884), however, to obtain some information on this point, an isolated *Agalma* was kept in a glass jar, and it dropped eggs which became segmented and later developed into primitive larvæ. The water in which it was confined was not changed meanwhile, nor new liquid added. Of course this experiment does not absolutely demonstrate that the spermatozoa from the same colony can or cannot unite with an unfecundated ovum of the same, for sperm may have been in the water before the animal was placed there. Experimentation on the subject has many difficulties; but it must be confessed, that, as far as I have thus far gone in my studies, it looks as if the male bells of an *Agalma* may sometimes fertilize ova from the same axis. The great difficulty in the artificial fecundation of the *Agalma* egg was pointed out by Metschnikoff.* The ovum in the gonophore is enclosed in what he calls an "Umhüllung," from the walls of which the tender egg cannot be extracted without harm to its contents.

The first naturalist to fertilize artificially the Siphonophore egg was Gegenbaur.† Metschnikoff‡ was equally unsuccessful with myself with the egg of *Agalma*. Haeckel * says that he made attempts to fertilize artificially the ova of the genera *Praya*, *Diphyes*, *Abyla*, *Hippopodius*, *Athorybia*, *Agalmopsis*, *Halistemma*, *Forskalia*, *Crystallodes*, and *Physophora*. "Die Mehrzahl der Versuche schlug fehl, und in vielen Fällen gingen die befruchteten und sich entwickelnden Eier zu Grunde. Ehe sie noch über die ersten bereits von Gegenbaur beschriebenen Entwickelungstudien hinaus die Entwickelungsvorgänge zu verfolgen, gelang mir nur bei drei Physophoriden-Gattungen, nämlich bei *Physophora* (bis zum XXVIII^sten Tage), *Crystallodes* (bis zum XXVII^sten Tage), und bei *Athorybia* (bis zum VII^ten Tage)." He does not state with sufficient exactness in the case of *Crystallodes*, the nearest ally of these three genera to *Agalma*, whether he artificially impregnated the ovum or not.

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* Studien über die Entwickelung der Medusen und Siphonophoren. *Zeit. f. Wiss. Zool.*, XXIV. p. 49.

† Beiträge zur näheren Kentniss der Schwimpolypen (Siphonophoren), p. 49.

‡ *Op. cit.*, p. 49.

The natural ovulation in *Agalma* was the only means of getting material for the study of the embryology; and as this happened seldom, even in instances when I had in confinement a large number of large and sexually mature specimens, the amount of material at my control was small. The youngest larvæ are very hardy, needing, for early stages at least, no change of water, provided decaying matter from the adult animal be not allowed to pollute it.

Each ovum is carried in a bell-shaped structure called the female gonophore. The female gonophores (Pl. I. fig. 1) are found in botryoidal bunches at the base of the polypites, and generally adhere to the neighboring hydrophyllium when it is broken from its attachment to the stem. The gonophore is fastened to the axis by its apex, through which a small tube communicates between a system of vessels called the radial tubes and the cavity of the stem. No marginal tube or marginal appendages of any kind were detected on the bell. The course of the radial tubes in the bell of the female gonophore (Pl. I. fig. 3) is very irregular, and varies very greatly in different individual gonophores. In a form of gonophore which was common, the following arrangement in the disposition of the tubes was observed. Two radial tubes arise from a common point under the apex of the bell, at the junction of the same with the tube of the apex. These lie in opposite hemispheres on the walls of the bell cavity. Consider the course of one of these radial tubes. After extending from under the apex of the bell about half-way down the sides of the bell on its inner surface, it bifurcates, each division passing at right angles to the course of the undivided tube. Each of the bifurcations passes around the bell parallel with the margin, and joins a corresponding bifurcation from the undivided tube of the hemisphere opposite that in which the bifurcation first described takes place. Before these bifurcations join, however, each sends a loop downward, which approaches the neighborhood of the bell margin, but eventually returns to the bifurcation.

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* Zur Entwickelungsgeschichte der Siphonophoren. Eine von der Utrechter Gesellschaft für Kunst und Wissenschaft gekrönte Preisschrift. Utrecht, 1869. p. 10.

The single ovum lies in a thin-walled sac,* which hangs from a point directly under the apex, and when ripe fills the whole bell cavity, sometimes projecting a little through the opening. The free gonophore is propelled in the water by violent contractions of the walls of the bell.

The male gonophore, like the female, is often found free in the water in which the *Agalma* is confined. When attached to the stem it is found in clusters at or near the base of a taster midway between two adjacent polypites. In many live specimens of *Agalma* some of the attached male gonophores will be found to have milk-white contents. Like the female, the male gonophore is commonly transparent.

The bell of the male gonophore is more elongated and larger than the female. It measures 2.5 mm. in length and .4 mm. in greatest diameter. At the apex of the bell there is a short peduncle by which it is attached to the adult. Through this peduncle there extends a tube, — the peduncular tube. There are are four thread-like simple radial tubes which have a direct course in the bell walls and unite with a circular marginal vessel. Each male gonophore has a narrow, thin velum. The bell walls are capable of quick contractions when free from the axis.

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* Whether the egg in the gonophore is surrounded by a membrane by which it is held there, or not, no one has clearly proved. I think such is the case. In the first place, the homology of the gonophore with the gonophores of other genera which have an ovisac would seem to point to such a condition in *Agalma*. In my figure of the egg just escaping from the gonophore a structure was observed in the bell cavity which called to mind the ruptured walls of such a sac. After the ovum was cast, there is reason to suppose that the "sac" is retained in the gonophore. Metschnikoff speaks of the egg of *Agalma* as "membranlos." Haeckel says the egg-cell of *Crystallodes*, "wie bei den übrigen Siphonophoren ist ganz nackt," and that of *Physophora*, "wie die Eier aller übrigen Siphonophoren sind dieselben durchaus hüllenlos." "*Hippopodius gleba*," writes Metschnikoff (*op. cit.*, p. 46), "ist die einzige mir bekannte Siphonophore, deren Eier mit einer freilich äusserst dünnen Membran überzogen sind." *Hippopodius* and *Vogtia*, according to Kölliker, have ovisacs in which, when in the gonophore, *numerous* ova are contained. I have also observed in a *Eudoxia* which resembles *E. Lessonii*, that here also we have *numerous* ova in an ovisac in the female gonophore, and there are many other similar observations on record.

The larger part of the cavity of the male bell is taken up by an ovate, slightly opaque mass, which is a sac inflated with spermatozoa. This sac, like the sac which carries the ovum, fills almost the whole cavity of the bell. The distal pole of the sac is closed.

Free spermatozoa are obtained in great quantities by simply pressing the body of the sac of the male gonophore, when they escape through the ruptures in the walls. The spermatozoa are the ordinary tailed variety with rounded, often pyriform heads, which are sometimes prolonged into a pointed end opposite the tail.

In the smaller female gonophores (Pl. I. fig. 1), and also in some others of larger size, we recognize in the contained egg a transparent cell, germinative vesicle, in which is a dot, and sometimes within the last are one or more granules. The mass of the egg, however, is formed of a clear substance, through which there extends a protoplasmic network, imparting the appearance of a complex spongy mass of polygonal cells to the egg contents. This network has not been figured or specially described by others in the egg of *Agalma*, although it has been seen by Metschnikoff and figured by him in *Epibulia*, *Stephanomia*, and *Halistemma*. Although he neither figures nor specially describes this network in *Agalma*, Metschnikoff* may have referred to it when he says: "Die vollkommern reifen membran- und kernlosen Eier [of *Agalma*] zeigen eine ähnliche Zusammensetzung wie die oben beschreibenen Eier der *Epibulia aurantiaca* und des *Hippopodius gleba*, unterscheiden † sich aber von ihnen durch ihre feinen röthlichgelbe Färbung, welches sie dem Vorhandensein eines diffusen Pigmentes verdanken." I shall return to these "cells" later, in my account of the progress of the growth of the egg.

Precisely how the spermatozoön comes in contact with the ovum, if the latter is placed in a closed sac, is somewhat of a puzzle. The germinative dot and vesicle disappear before this sac is ruptured. At about this time one or two globules (*p g.*) were observed on the egg. In my figure the nucleus and nucleolus have not disappeared. These changes go on so fast, that I am not confident that both are found together, and the globules may have appeared after the disappearance of dot and vesicle. These globules seem to be the same as the "deformed spermatozoa" described in another genus by P. E. Müller. If the disappearance of the clear cells denotes that fecundation has occurred, how have the spermatozoa effected an entrance into the egg? The germinative vesicle and dot disappear probably before the gonophore is detached from the axis of the adult, and, without doubt, before the egg leaves its gonophore. In the immature gonophore in which the body *pg.* was seen, the opening into the bell cavity of the gonophore had not formed. Whatever the cell *pg.* may be, spermatozoön or polar globule, both germinative dot and vesicle disappear before the ovum leaves its gonophore. If this event is a result of an impregnation, there seems to remain but one conclusion, — namely, that the fertilization of the ovum takes place in the gonophore. We are led to suppose that the spermatozoa either penetrated the sac walls of the ovum and gonophore, or passed through the apical canal, which is not in free communication with the surface of the ovum. It seems more natural to adopt the latter supposition, unless we suppose that nucleus and nucleolus vanish before impregnation. The cell, with its enclosed cellular body, which we have called the nucleus and nucleolus, disappears and leaves the egg of homogeneous appearance, with the contents made up of the protoplasmic network of cells already mentioned. The next change is that by which the egg separates itself from the sac in the gonophore in which it is contained.

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* *Loc. cit.*, p. 49.

† The statement of Metschnikoff, p. 46 (quoted above), that the eggs of *Hippopodius gleba* "mit einer freilich äusserst dünnen Membran überzogen sind," would seem to be another difference.

Several authors have commented upon the peculiar sinuses which are sometimes found at this time in the female bell about the egg. These sinuses are of many shapes, and lie between the egg and its membranous sac (Pl. I. fig. 2). They have the appearance of spaces left here after preliminary movements of the ovum before escape from the gonophore, or by a shrinkage of the walls. A single gonophore (fig. 4) was observed in which the ovum was in the act of escape; and in that gonophore the folded remnant of a structure, which may be the sac which formerly enclosed the egg, was seen just under the apex of the bell in its cavity. The diameter of the opening into the cavity of the bell was in this instance observed to be smaller than that of the egg, so that the egg in some instances suffers a considerable compression before it escapes from the cavity of the gonophore. After the egg leaves the gonophore it assumes a spherical form, with a diameter of .45 mm. (Pl. I. fig. 6). One pole is ruby in color, the other transparent. The network of protoplasm which extends through the entire contents imparts to it a cellular appearance, while a thin layer, probably of protoplasm, is found over its entire surface.

Cleavage.

First Cleavage Furrow. — Gegenbaur,* who says that he observed the segmentation of the ovum of the genera *Agalmopsis*, *Physophora*, *Forskalia*, *Hippopodius*, and *Diphyes*, states that the whole process of segmentation is finished in from twenty-four to thirty-six hours. Haeckel† says that in *Physophora*, *Crystallodes*, and *Athorybia* the segmentation is finished at the end of the second day. Metschnikoff does not state the exact limit of time when the segmentation is finished, although from the age of the youngest larva of *Agalma* which he figures I should judge that the segmentation was accomplished in the second day. All recorded observations on Siphonophore eggs point to the conclusion that the cleavage is wholly completed before the beginning of the third day after fecundation.

My first specimen of *Agalma* was captured on August 6th, at noon, and before the morning of August 8th it had laid eggs which were in the same stage as that figured by Metschnikoff on the fourth day. In other words, a little over a day and a half after the *Agalmata* were placed in the aquarium, eggs from them had segmented and had formed the two layers described by Metschnikoff in the changes of the fourth day. My observations are thus at variance with those of Gegenbaur, Haeckel, and Metschnikoff. What is the meaning of the discrepancy? Looking over my notes in vain to find an error in this particular, it has seemed possible that errors of observation have crept in for the reason that individual eggs have not been followed through their consequent stages. An *Agalma* in captivity will mature its eggs at different times, so that at the end of the fifth day segmented eggs in company with those which are far along in the development of the primitive hydrophyllium may be picked out of the same water. From the nature of the case, unless individual eggs are isolated and the time of their fecundation recorded, it is impossible to know the age of any specified stage.

The first change which takes place in the spherical egg after it has left the gonophore is the formation of the primary cleavage furrow, *pr.* At one pole of the ovum (Pl. I. fig. 7) an indentation appears in the form of a furrow on the surface of the egg. Although I have not observed at the outset the exact relationship of this furrow to the rosy pole, I have seen that later, after the first plane of cleavage has been

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* *Op. cit.*, p. 50.

† *Op. cit.*, for *Physophora*, p. 19; for *Crystallodes*, p. 51; for *Athorybia*, p. 89.

completed and the egg is in the 2-cell stage, this plane passes through a rosy pole. While this gap in observation is too important to be overlooked in studying the relation of the primitive plane of cleavage to the poles of the egg or the axis of the adult animal, enough has been observed to show that the first plane of cleavage passes through the pole of the egg adjacent to that part of the sac which is attached to the gonophore, if the rosy pole of the egg in the 2-cell stage and that of the egg in the gonophore are the same. We are able to identify a rosy pole in the egg, even into those post-segmented stages when the embryo begins to push out the two layers of the primitive hydrophyllium on the surface of the yolk; and while we have not traced the continuity of this pigment in an egg in this stage with the segmented egg older than the 8-cell stage, the presumption is that the poles are the same in both cases.

The primary furrow, *pr.*, bending into the ovum on one side of the *Agalma* egg, causes many obscure or sharply defined folds on each side. Similar plications are also mentioned and figured by Metschnikoff * in *Epibulia.* The egg at this time as shown by Metschnikoff in the latter genus resembles the ova of *Geryonia* and the Ctenophora.

As the groove on the animal pole deepens, changes in the external contour of the egg follow with great rapidity. I have timed the duration of a few of these variations, and give camera drawings to illustrate their appearance at intervals of time.

At 8 h. 45 m. in the morning the indentation which marks the appearance of the primary cleavage furrow has just begun to appear. The egg at this stage is smaller than that just laid, but whether this diminution in size is due to the changes which result from the formation of the primary furrow or individual variation, we have no data by which to determine. The diameter of *this* egg in the plane connecting the pole where the furrow has taken place with the opposite is .30 mm.; the longer diameter is .35 mm. The profile of the egg, looking at it in a plane at right angles to the primary furrow, is oval or slightly notched at one pole.

Fifteen minutes later, at nine o'clock A. M. (Pl. I. fig. 7), the profile of the same egg in the same position has become still more heart-shaped, and the primary furrow has deepened to an amount greater than the radius of the egg. The depression forming the primary furrow almost girts the egg, extending over the surface for more than two thirds its circumference.

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* *Op. cit.*, p. 40.

At 9 h. 10 m. A. M. (Pl. I. fig. 8) the primary furrow, *pr.*, has deepened still more, and the constriction has encroached more than before on the whole circumference, so that now the two hemispheres of the egg are connected by a narrow band or "bridge" of protoplasm, the breadth of which is about .05 mm. The longer diameter of the egg is .35 mm.; the shorter, .25 mm.

At 9 h. 20 m. A. M. (Pl. I. fig. 9) the constriction has grown wholly around the egg and the primary furrow has deepened so much that a small protoplasmic band .02 mm. in diameter is all that now connects the two cells. The other dimensions are about the same as the corresponding diameters of the egg at 9 h. 15 m. A. M. (fig. 9), although it was noticed that one hemisphere of the 2-cell stage was slightly smaller than the other.

At 9 h. 25 m. A. M. (Pl. I. fig. 11) the cell which was the smaller has grown in size so that now both cells of the 2-cell egg are of uniform size. At 9 h. 30 m. A. M. (fig. 12) the two cells have been pressed closely together, and the first plane of cleavage (1 *cl. pl.*) has been fully formed, although the undivided part of the egg still remains in the form of a slight bridge connecting the two cells which form the egg. No nuclei were observed in either of the cells.

It will thus be seen that the development of the 2-celled ovum from the time the primary furrow first appears up to that when the first cleavage plane is well formed is forty-five minutes. For a long time after the formation of the first cleavage plane has been effected, both hemispheres of the egg exhibit abnormal changes by which the egg is made to assume curious, often grotesque forms. Here and there over the surface of the egg rise pseudopodic elevations, which sometimes take the form of long rhizopodal threads. Later, these extensions sink back into the substance of the egg and new combinations arise. The two spheres, or hemispheres, now draw away from each other, or become squeezed together. They lose their globular, symmetrical form, and their profiles become more angular, or sometimes the angles are pushed out into conical projections. These changes often foretell the immediate death of the egg, but full as often take place in healthy ova which reach a good old age.

A considerable length of time may elapse before the initial changes leading to the formation of the second plane of cleavage can be detected. We are not in my judgment justified in supposing that the vital forces of the egg are "resting" at that time until we know more accurately the state of the interior and the changes which are going on there.

This is the nearest approach which we have in the *Agalma* egg to a "resting stage."

Second Cleavage Furrow. — How much time intervenes after the formation of the first cleavage plane before signs of a second furrow appear, has not been accurately observed. It is thought to be about thirty minutes. In a stage of segmentation, not raised from that just described, but like it also in the 2-cell stage, it was possible to follow the whole progress of the growth of the second furrow. This egg was not raised from those formerly described, but was picked out of the water, and was observed in the 2-cell stage on the fourth day after the *Agalma* was captured. At 1 P. M. (fig. 13) it showed the first trace of the second cleavage furrow, and an hour later the egg had passed into the 4-cell stage. The changes of that hour are as follows as far as external form goes.

If we suppose this egg to be placed in such a position (fig. 13) that the first plane of cleavage (1 *cl. pl.*) is vertical, there will be observed on one side of this plane, viz. in the left-hand cell, a slight depression or furrow (*se.*) indicated at first by a variation from a straight line which the plane seen in profile seems to have. This depression is caused by the infolding of the surface of the egg at that point, and is the beginning of the second cleavage furrow. The furrow is at first at right angles to the primary furrow, and in its earliest condition one cell only of the 2-cell stage is modified.

At 1 h. 10 m. P. M. (*se.*, Pl. I. fig. 14) the growth of the furrow is very slight. The depression has deepened, the chasm widened, and folds similar to those described in the walls of the primary furrow have been developed.

At 1 h. 15 m. P. M. (Pl. I. fig. 15) the second cleavage furrow (*se.*), while extending itself and deepening in the left-hand cell, has appeared also in the right-hand as well. It is now no longer placed at right angles to the primary cleavage plane, but lies across it at an angle of from 60° to 65°. A slight predominance in size of the left-hand end of the furrow is shown in the figure. The diameter of the egg at right angles to the first plane of cleavage is now about .60 mm.; the shorter diameter, about .45 mm.

The growth of the egg in the next three minutes is important. At 1 h. 18 m. P. M. (fig. 16) the second furrow has lengthened and deepened, growing in such a way as to produce a certain twisting in the first plane of cleavage. A contortion of the first cleavage plane, 1 *cl. pl.*, is brought about by the growth of the second furrow. In an egg seen in the same plane as in former instances, the line indicating the first plane of cleavage, which in them was unbroken, is bent at right angles at the point where the secondary furrow has appeared. The second cleavage furrow is at this time a little over .15 mm. long. The longer diameter of the egg is .60 mm.; the shorter, about .45 mm.

The general appearance of the egg two minutes later than the last, or at 1 h. 20 m. P. M. (fig. 17), although in most respects similar to it, has several marked differences, the result of the progressive growth. One of the most striking of these differences is the still greater increase in the amount of the deviation from a straight line which now separates the lower end of the upper line from the upper end of the lower vertical, both being the profile of the first cleavage plane, 1 *cl. pl.* The length of the second cleavage furrow, *se.*, has now increased to .25 mm., its breadth remaining about the same, and in its sides are frequent plications running parallel with the first cleavage plane, much more sharply defined than in any which has preceded it. Up to the present time (fig. 17), twenty minutes after the first visible changes by which we pass from an egg with two cells into one with four, the secondary furrow has been limited in its extension. It now slowly deepens, and at the same time grows along the surface of the ovum toward the equator, although at 1 h. 20 m. it has not yet extended far enough to reach the periphery of the egg as seen in profile. There is as yet no indentation marking the limit of the second cleavage groove on the equator of the egg.

In the same egg five minutes later, at 1 h. 25 m. P. M. (fig. 18), the second furrow, *se.*, is found extending across the whole hemisphere, and is represented in the figure by the large horizontally placed furrow. The size and depth of this indentation may be estimated by the depression at either extremity of this furrow. In profile it is seen to equal in depth the radius of the egg. Like the primary groove, *pr.*, this likewise eventually extends almost through the egg, dividing it into two symmetrical hemispheres connected by an undivided "bridge." The walls of the furrow, still grooved with cleavage folds, have not yet begun to approximate. In this stage (fig. 18), although we seem to have four segmentation spheres, the second plane of cleavage does not extend more than two thirds across the diameter of the egg as seen from the original surface of infolding. On the side of the egg away from the observer, the 2-cell stage was slightly grooved by the second furrow. The sides of the second cleavage furrow have not yet begun to draw together. At this time in the growth of the ovum the walls of the second furrow on each side, and especially at the peripheral extremities, or that part most distant from the primary plane of cleavage, exhibit rhizopodal elevations similar to those which accompany the formation of the primary furrow, and which we shall later see are found to form especially in later stages of growth, wherever a new plane is about to appear. Similar rhizopodal phenomena are also premonitory of death in the cells of the egg.

At 1 h. 30 m. P. M. (fig. 19), half an hour after the secondary cleavage furrow began to appear, the secondary groove (*se.*) shows signs of closing, and the walls draw together to form the second cleavage plane (2 *cl. pl.*). The closure of the secondary furrow takes place in substantially the same manner as the primary, and begins at the junction with the primary, working gradually to the periphery. All the time that the growing together of the sides of the furrow is going on, as the movement of closure advances towards the equator it is accompanied by the formation of new folds and the pushing out of pseudopodia in the line of its advance. In my figure representing the egg at 1 h. 30 m. P. M. these folds can be seen in the left hand of the figure, where the furrow is only partly closed.

By the closure of the second furrow, combined with the contortion which is thus caused in the primary plane of cleavage, the profile of the first plane (primary), *pr.*, appears zigzag, or the line which was formerly vertical is now not straight from one pole to the opposite, but is broken midway in its course. As this vertical marks the direction of the primary cleavage plane (1 *cl. pl.*), we have indications that the primary cleavage plane, once intact, is now broken or bent. That modification in this plane can be recognized in later stages of development, being seen as late as the 8-cell stage. The diameter of the egg on the primary cleavage-plane is about .60 mm.; on a plane at right angles, .45 mm. The segmentation spheres have no visible nuclei. The great mass of the ovum is transparent, and the part surrounding the upper end of the vertical line, which is the primary plane of cleavage, is of a rosy color.

The next stage of cleavage, 1 h. 35 m. P. M. (fig. 20), thirty-five minutes after the beginning of the modification of the 2-cell stage, differs very slightly from that just described. The second cleavage furrow (2 *cl. pl.*) is now closed almost to its very periphery, although protoplasmic elevations are seen at intervals along the furrow, a sure sign that the process is not yet completed. Remnants of the unclosed furrow are seen at each end of the horizontal furrow (2 *cl. pl.*).

At 1 h. 45 m. P. M. (fig. 21) the protoplasmic forces are still active in sending out the rhizopodia, and the secondary cleavage plane (2 *cl. pl.*) is not wholly formed, and at 1 h. 55 m. P. M. (fig. 22) the 4-cell stage is practically complete, although here and there, as at the left of the figure, a slight protoplasmic elevation can be seen. The second plane of cleavage is practically formed.

An hour and ten minutes, 2 h. 10 m. P. M. (fig. 23), after the 2-cell stage we have an egg divided into four cells by two planes at right angles to each other. None of these cells have a nucleus, and all are still penetrated by the network of "cells" which we have already described in the unsegmented ovum. The vertical plane passes through a rosy region of the egg; the opposite pole is more transparent. The diameter of the egg on the first cleavage plane is a little less than .50 mm.; on the opposite plane, about .45 mm. Although on the face of the egg which is before us the ovum is divided into the 4-cell condition, I have not been able to observe the opposite pole. Subsequent stages seem to indicate that the secondary plane does not extend wholly through it, but that at the opposite side there still remains an undivided surface. Later changes in the general outlines of the ovum lead me to suspect that the undivided part, either by growth or protoplasmic extension, is of considerable size after the formation of the 4-cell stage.

Third Cleavage Furrow. — The appearance of another cleavage furrow on the same egg, the third which has been traced, was first noticed at 3 h. 15 m. P. M. (Pl. II. fig. 3), two hours and thirty minutes after the 2-cell stage. In the mean time certain changes in the contour of the egg which are not fully understood had taken place. At 3 h. P. M. (Pl. II. fig. 1) the primary (1 *cl. pl.*) and secondary (2 *cl. pl.*) planes of cleavage, represented by the vertical and horizontal planes, occupy the same relative position as formerly, and the right-hand cells are in the main the same in contour. On the side of the left-hand cells, as figured, away from the observer, has appeared a large undivided lobe (*et.*), a little smaller than the original left-hand cell of the 2-cell stage. The egg has probably been slightly rolled on its axis, by which the large undivided lobe is turned into sight, whereas formerly it was concealed behind the two left-hand cells of the 4-cell stage. I was not able to observe satisfactorily the origin of this large lobe. The only explanation which can at present be given to account for its existence is one suggested above, that it is the bridge or connecting band which has not been divided by the second cleavage furrow. If, however, its fate resembles that of the protoplasmic bridge of the primary furrow, my explanation is probably erroneous.

The large lobe is the point of origin of a new cleavage furrow, which I have called the tertiary or third cleavage furrow (3 *cl. pl.*). In the general structure and mode of origin the third cleavage furrow bears a striking likeness to the primary and secondary. It forms at right angles to the direction of the second furrow and parallel with a part of the first furrow in the large undivided lobe on the left-hand side. At 3 h. 5 m. P. M. (Pl. II. fig. 2) the tertiary furrow had not begun to appear; but ten minutes after, at 3 h. 15 m. P. M. (Pl. II. fig. 3), it had reached a considerable size. Like the primary and secondary furrows, the walls of the tertiary are formed by an infolding of the surface of the ovum, and have the characteristic sharply defined folds and plications already mentioned.

Figures of the egg at 3 h. 20 m. P. M. (Pl. II. fig. 4), and at 3 h. 25 m. P. M. (fig. 5), are introduced in order to show the progress of the growth of the tertiary furrow in the division of the large undivided lobe on the left-hand side of the egg. At 3 h. 30 m. P. M. (fig. 6) two hours and a half after the formation of the first cleavage furrow, the tertiary furrow has divided this lobe horizontally into two smaller cells. The portion of the tertiary plane which bisects the large lobe is, like the primary and secondary, perpendicular to the plane of the paper on which the egg is figured. The two axes of the egg, a vertical, which is the original cleavage plane, and the horizontal, the secondary plane, are easily distinguished, and at one end of the tertiary furrow, now almost completely closed in, there is figured a marked protoplasmic elevation. This stage is a 6-cell stage, composed of the four cells which have already been mentioned and the two additional which have just formed. The tertiary furrow was the third furrow observed, but I suspect that between the secondary and tertiary (by my nomenclature) the large lobe which I have represented as divided by this furrow was constricted from the two left-hand cells by another, whose growth was not observed.

Morula.

The complications in the growth of the ovum after the stage last mentioned make it very difficult to follow the birth of new segment spheres or cleavage planes. The last stage of the egg in which the course of the original cleavage can be traced with any certainty is at 3 h. 45 m. P. M. (Pl. II. fig. 7), or two hours and three quarters after the formation of the first cleavage, when we have an 8-cell stage. From this we pass into morula stages, in which additional cleavage planes were not successfully traced as they originate, and in which the primary and secondary planes could not be recognized as such.

Before leaving the stage (fig. 7) in which the egg was found at 3 h. 45 m. P. M., let me mention an appearance in the egg which was not understood, but which may have a significance in the embryology of these animals. At the point in the egg adjacent to the break which has taken place in the direction of the primary furrow, a depression is formed which resembles an opening leading into the interior of the ovum. From the arrangement of the cell walls in the immediate vicinity, it seemed as if this opening was formed by the drawing apart of the walls of the cells, but whether it is the result of decay or not cannot be at present stated. The single egg in which it was observed, however, afterwards died before passing into advanced larval conditions.

It is at about this time in the development of the *Agalma* egg that some of the most extraordinary examples of protoplasmic elevation from its surface were observed. The resulting changes in external form often baffle all attempts to observe accurately the normal outlines of the cells of the segmented egg. These rhizopodal prominences are most clearly marked in those eggs which have been in long captivity, and seem wholly different in different ova.

Before closing our account of the segmentation, let us compare our observations with those of other naturalists on the same or closely allied genera. The poverty of our knowledge of the segmentation of the egg of the genus *Agalma* is so great, that I find few descriptions in the writings of others available for comparisons. Metschnikoff, although not figuring the segmentation of the egg, evidently observed it, as the following mention indicates. He says,* "Die Dotter zerklüftung, resp. Larvenbildung findet auf dieselbe Weise statt, wie ich oben für *Epibulia aurantiaca* angedeutet habe und wie sie bei allen von mir beobachteten Siphonophoren als Regel gilt. Was aber die Vorgänge der Organbildung betrifft," he continues, "so finde ich die meiste Analogie mit den von Haeckel untersuchten *Crystallodes rigidum* und *Athorybia rosacea*, obwohl auch in dieser Beziehung *Agalma Sarsii* manches Eigenthümliche darbietet." Turning for further information to his account of the segmentation in *Epibulia* we find him devoting a few significant paragraphs to this interesting process. He says,† "Die bald auf das freie Ablegen (es gelang mir nie künstlich aus dem Schlauche befreite Eier

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* *Op. cit.*, p. 49.

† *Op. cit.*, pp. 40, 41.

zur Entwickelung zu bringen) folgende Eizerklüftung beginnt nur an einem Pole, in einer Weise, wie ich oben für *Geryonia* angegeben habe. Es bildet sich an dem besagtem Ort eine Furche deren Wände durch eigenthümliche Falten ausgezeichnet werden, welche ein deutliches Zeugniss von der Festigkeit der peripherischen Protoplasmaschicht abgeben. Die besagte Furche vertieft sich in Meridianaler Rechtung gegen den anderen Pol zu, das ganze Ei in zwei Hälften zertheilend, die nur durch eine Brücke zusammengehalten werden. Schliesslich zerfällt das Ei in zwei gleich grosse sog. Furchungskugeln, ohne dass an ihnen irgend eine Spur der originalen Entstehungsweise erhalten bleibt. Das zweikugelige Ei zerfällt auf eine ähnliche Weise in vier Theile, welche sich wieder vermehren, und der sog. regelmässige Zerklüftungsprocess setzt sich weiter fort, bis das Ei in Eine mehrzellige vermittelst der Flimmerhaare freischwimmende Larve verwandelt wird." This account of the segmentation process in *Epibulia* is certainly the best which we have of this period in the development of any Siphonophore. It is, however, the history of the growth of the egg of a Calycophore, while *Agalma* is a Physophore. The value of a comparison of the two is of greatest importance in phylogenetic studies of the respective groups, as showing how close this process is in widely different genera. The segmentation of the Siphonophore egg, as followed by Gegenbaur and Haeckel, differs considerably from that of *Agalma*. The description of the former naturalist is short, but concise. Segmentation was observed by him in several genera. He says:* "Num folgt rasch die Theilung des Dotters, die mit dem Auftreten einer ringförmigen Furche um den Aequator des Eies sich einleitet. Dies wiederholt sich dann an jedem Theilungsproducte, bis das ganze Ei aus einer Masse gleichartiger Furchungskugeln besteht, die ihm das bekannte 'Maulbeerförmige' Aussehen verleihen. In 24–36 Stunden ist der ganze Process vollendet. Ein hier besonders genau zu verfolgender Umstand ist die jedesmalige Theilung des Keimbläschens, welche der Theilung des Dotters vorausgeht; in gleicher Weise verhalten sich dann auch die Theilungsproducte des Keimbläschens zu der Bildung neuer Dotterkugeln." The division of the "Keimbläschen," which was not observed in *Agalma*, is thus reported in at least one genus by Haeckel. In *Physophora* he says:† "Ich kann diese positive Beobachtung Gegenbaur's, welche für die theoretisch wichtige Frage von der Continuität der Zellengenerationen von hoher Bedeutung ist, durch mehrfache eigene Beobachtungen bestätigen.

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* *Op. cit.*, pp. 49, 50.

† *Op. cit.* for *Physophora*, p. 18; for *Crystallodes*, p. 51; for *Athorybia*, p. 89.

Der ersten Halbirung des Eidotters geht die Halbirung des Keimbläschens, und dieser wiederum die Halbirung des Keimfleckes voraus." The segmentation of *Crystallodes,* he says, "ist nicht wesentlich von demjenigen der *Physophora*-Eier verscheiden, welchen wir oben bereits geschildert haben." And later, "Der Furchungsprocess des Eies weicht bei *Athorybia* nicht von der oben geschilderten Eifurchung von *Crystallodes* und *Physophora* ab."

Development of the Primitive Covering-Scale.

Epiblast, Hypoblast. — The morula (Pl. II. fig. 8) now becomes covered with a granular layer of ciliated cells whose origin was not observed. This layer is thickest at one pole, where its walls have a reddish color. It has well-marked granular nuclei, which with acetic acid (Pl. III. fig. 2) are found most abundant at the rosy pole. The rosy pole of the segmented egg with its investing layer is supposed to be the same as the rosy pole of the first cleavage plane, and will be spoken of as the "germinative pole," or the "area germinativa." In *Crystallodes,* according to Haeckel,* it is "ein kreisrunder dunklerer Fleck, und zwar an derjenigen Stelle der Oberfläche welche dem späteren aboralen oder proximalen Pole der Längsaxe entspricht. Dieser Fleck, der Fruchthof (*area germinativa*) genannt werden kann, ist bedingt durch eine rasche Vermehrung der Zellen an dieser Stelle der Oberfläche." Metschnikoff † says in his account of the development of *Agalma:* "Die erste embryologische Erscheinung bei der freischwimmenden vier Tagen alten Larve besteht in der Ablagerung einer peripherischen Ectodermschicht, welche jedoch auf einer Hälfte des kugeligen Körpers (die ich fortan als die obere bezeichnen werde) viel dicker als auf der anderen ist. Am folgenden Tage kommt auch das Entoderm zum Vorschein, sich unmittelbar unter der verdickten Stelle der äusseren Schicht concentrirend."

The earliest appearance of the superficial layer in *Agalma elegans* was not observed to be confined to one pole, but in the youngest stages observed the layer completely surrounds the egg; it is only later, *dm* (Pl. III. fig. 1), that it thickens at the pole known as the germinative pole. There is a noteworthy fact in the growth of *Agalma*, that, whenever a new organ is formed on the surface of the *Agalma* egg, we have a concentration of the reddish pigment at that place, while the color, when present, is more diffused on other parts of the egg. This law holds good

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* *Op. cit.*, p. 53.

† *Op. cit.*, pp. 49, 50.

in the formation of that polar elevation which marks the origin of the primitive hydrophyllium, the first-formed organ of the larva. The various designations which have been used in the nomenclature of the two poles of the egg in this and following stages admit of misinterpretations. If we call the pole at which the increase of the thickness in the surface layer takes place the upper pole, we convey a wrong impression as to its natural position in the water; for if we observe the position in which the egg floats in stages a little older, it will be seen that the so-called upper ("obere") pole is always downward, as it naturally would be brought in equilibrium by the increase in weight resulting from the growing organ. Not less misleading are the terms oral and aboral. When the mouth of the first-formed polypite appears, it is in a position 90° from that pole (the *area germinativa*) at which the primitive hydrophyllium first forms. The aboral pole is therefore 90° from the position assigned to it, if the terms have anything more than an arbitrary significance. The rosy color seen at one pole of the unsegmented egg dates from the time when the ovum was in the sac within the gonophore. At that early stage the pole of the ovum opposite the attachment of the sac is rosy in color, and through all stages of cleavage up to one with eight cells that same rosy pole has been recognized. Here (8-celled stage) the relations to the axis were lost; but a rosy region was still to be seen, and it seems legitimate to conclude that the rosy pole is identical in these cases, rather than that the color has migrated from one region of the ovum to another in unseen stages intermediate between those submitted to exact observation. Moreover, going a step farther, can we not also regard that pole where the single layer is beginning to thicken, and which has the same reddish color, as identical with those which we have studied? I think we can suppose that the rosy color in this stage indicates the same pole which is marked out by it at the very beginning, — the same, in fact, through which the first cleavage plane was observed to pass. Although I have spoken of this pole as the germinative pole, its axis is not the same as the axis of the adult animal. The investing layer spread over the surface of the egg is thickest at the germinative pole, and diminishes in thickness gradually to the opposite pole. The thinning out of this layer is a regular diminution on all sides; and up to the present time there are no right and left sides to the layers which cap the germinative pole.

In the next stage (Pl. III. fig. 3) following the last, the ovum, instead of being spherical, has become more elongated, assuming the form of a prolate sphere, and the portion directly under the germinative pole has been raised by a slight constriction, forming a swelling on the external surface. At this time we can distinguish two layers, *eb.*, *hb.*, in the undivided single layer of the former stage, while between them, as they lie one above the other, there is a slight thin crescent-formed space, which later increases in size, and is filled with a third layer. The elevation, apparently three-layered, with the part of the yolk immediately below it, forms a disk-shaped body with concave surface resting upon the spherical egg. This disk hangs downward as the egg floats in the water. In another egg (Pl. III. fig. 4) of about the same age, the shallow constriction which marks off the disk from the remainder of the egg is somewhat magnified. Although the general outlines of this embryo are distorted (the constriction being too deep), the stage is an interesting one as showing on one side a slight notch which has appeared in the outer layer, *eb.* The existence of this notch enables us to determine certain primary axes, formerly not distinguishable, on the surface of this larva, which have relations to the axis of the adult *Agalma.* Before passing to this point, let me say that the outer of the two layers is the epiblast, the inner the hypoblast, and the layer of the intermediate chamber the middle layer (*mb.*), later constituting the gelatinous mass of the hydrophyllium. The custom of looking at the float as a starting-point for reference of organs, and using the terms proximal and distal in reference to this structure, has been adopted in the writings of some naturalists. This nomenclature can as well be followed here in the larva as in the adult. The float, although in *Agalma* it is not the first structure to appear, can be regarded in the young, as in the adult, as situated at a fixed point or pole for reference when studying other organs, since in all genera it is the first permanent structure which appears.

It will be found in the subsequent history of our larva, that the float develops near by a region of the disk opposite to that in which the notch in the outer of the two layers lies. We can approximately say that in Pl. III. fig. 4 it will appear just below the indentation on the left hand, as the figure is drawn. The whole of the disk-shaped elevation which has formed on the egg and destroyed its sphericity lies, therefore, on one side of the future float. That side may be called the germinative side, for on it appear one by one all the remaining organs of the *Agalma* body. They have, however, at first no regularity in the position in which they form. Using the nomenclature which has been suggested, the notch is on the distal side of the disk, as it is most distal from that pole of the ovum later to be occupied by the float. The hemisphere of the ovum which faces the observer may be called the right side, as referred to an axis passing through float and distal rim of the elevation, and that opposite the left, for reasons which will soon appear.

The larva is now a little over two days old. The many cleavage planes, *cl. pl.*, forming the polygonal segmentation spheres in the yolk are clearly defined. The protoplasmic network, *vt. c.*, throughout the ovum, is likewise still well marked. The outer of the two layers, or the epiblast, is ciliated externally. At the elevation on the germinative pole it has a reddish color. The layer beneath the epiblast, or the hypoblast, is thinner than the more superficial. A horizontal diameter of the egg is .45 mm.; the longest axis at right angles to it, and passing through the germinative pole, is .55 mm. Both epiblast and hypoblast together at the thickest point are not more than .01 mm. in thickness.

In a slightly older larva (Pl. III. fig. 5) the significance of the notch at the distal rim of the primitive elevation of the germinative area becomes more apparent. The epiblast and hypoblast, formerly of about the same thickness, have in this stage somewhat changed their relative dimensions, and when seen in profile are observed to have assumed folds which are of significance in the shape of the future covering-scale. The epiblast on the distal side of the disk-like elevation has thickened, and two well-marked angles appear on its exterior. Its surface on the distal side rises by a smaller angle from the yolk surface than on the proximal, and slopes away more gradually to the opposite side. The hypoblast hugs the yolk cells at all points except at one place (*c. p. l.*), where it rises from them, leaving a recess which is later the cavity of the primitive larva. Near by this cavity the hypoblast is slightly separated from its enveloping layer, the epiblast, by a middle or third layer. The two angles found on the surface of the epiblast at the distal rim of the forming disk have grown more prominent, as shown in the two following sketches (figs. 6, 7), and the two layers have separated more and more from each other.

When looking at the egg in its present stage of development, we notice at once how sharp the difference is between the proximal and distal portions of the rim of the disk-like elevation. They differ very much in shape from each other; and this difference is magnified as we follow the course of the development into older larvæ. In the light of what is known of the existence of bilateral symmetry in the adult *Agalma*, we may regard this difference in the two borders of the scale as among the earliest expressions of that condition. The forming disk possesses a proximal and distal border, and therefore a right and left side, as referred to a line passing through these regions. This line lies in the same plane as the axis of the adult *Agalma*, although it is not clear that the right and left sides of the disk-like elevation correspond with the right and left sides of the appendages later found on the adult *Agalma* axis. The general appearance of the yolk and the size of the egg is approximately the same as in the preceding stages. The right and left sides used for figures up to Pl. III. fig. 4 have not the same significance as here interpreted.

The next oldest larva (fig. 9) differs primarily from the last in the greater elevation and prominence of the layers formed on the yolk. The epiblast and hypoblast are much thicker; the former has a reddish, the latter a yellowish color. The constriction around the elevated disk between its edges and the surface of the ovum has deepened o the distal side of the elevation as seen in profile, but the indentation is very slight on the proximal side.

Within the disk a gelatinous layer, so transparent as to be invisible, has formed by a separation of the epiblast and hypoblast. The thickness of this layer is greatest near the distal end of the disk. Yellow and reddish pigment is found in the epiblast on the surface of the yolk sac. It was also noticed that the epiblast at *pn. cy.*, near the proximal end of the elevated disk, is much thicker than that near the distal side, and that there was a tendency to form a slight epiblastic elevation at that point. If the reader will compare the figure of this stage with one of about the same age by Metschnikoff, he will find a great difference in external shape between the two. My larva is approximately the same as Pl. VIII. fig. 5 in the oft-quoted work by that author, who says that his larva is five days old. My adult *Agalma* was put in the aquaria on August 6, and the stage represented in fig. 8 was found free in the water on August 8, or two days later. I likewise picked out of the same water three days after, or five days after the adults were put there, larvæ of the same age, while with these were still others much farther advanced, and some which were just passing through the early stages of segmentation of the egg.

I find a discrepancy, which may be a generic difference, in the rate of growth day by day recorded in Haeckel's observations on the development of *Crystallodes*, and Metschnikoff's of *Agalma*. In larvæ of *Crystallodes* four days old the float was as far advanced as in the *Agalma* six days old of Metschnikoff, while on the second day both the *Agalma* and *Crystallodes* larvæ were still in a morula stage. These discrepancies arise from the difference in the mode of growth of the float in the genera, or from the fact that different clusters of eggs, or different members even of the same cluster, mature at different times. We must not suppose, in studying the development of *Agalma* eggs, that the ova found free in the water were all cast at the same time. The only trustworthy method of observation is to trace individual eggs into larvæ and time their development, which is a most difficult thing to accomplish successfully with these tender creatures. Even if we follow and time with care the rate of growth in our glasses, it is a question whether we should not make an allowance for retardation or acceleration of this time brought about by changes in the temperature of the water in which they are placed in our aquaria.

The disk formed at one pole of the egg by the epiblast, hypoblast, and an intermediate transparent layer, may be called the primitive hydrophyllium or covering-scale, to distinguish it from others which are later formed. In a stage following the last this body has assumed an elevation upon the surface of the egg greater than formerly. As far as its general outlines go, no great change has taken place in the larva with advancing age; but near the rim of the disk another minute elevation in the walls of the epiblast has pushed itself up, which is destined later to play an important part in the structure of the adult. This elevation (*pn. cy.*), which at this time cannot be distinguished from a simple bud such as any other organ of the *Agalma* body at first has, is the beginning of the future float. It is a true bud, as already pointed out by Metschnikoff.

The accounts which Metschnikoff and Haeckel give of the origin of the float in genera so nearly related as *Agalma* and *Crystallodes* are radically different. In *Crystallodes*, according to Haeckel, the air-sac originates from the primitive cavity as a bud. Speaking of changes on the sixth day, he says: * "Die wichtigste Veränderung aber, welche am sechsten Tage eintritt, ist die vollständige *Abschnürung des Luftsackes* von dem Centralraum der Primitivhöhle. Das Entoderm, welches die Wand des Luftsackes bildet, und welches bisher an seiner Einmündung in die Centralhöhle unmittelbar überging nach oben in das Entoderm des Deckstück-Nährcanals, nach vorn in das Entoderm des Polypiten, wächset nun vollständig an dieser Stelle zusammen. Der Larvenkörper enthält also nunmehr zwei vollständig getrennte und geschlossene, mit Flüssigkeit erfüllte Höhlen: die einfach rundliche oder längliche runde Luftsackhöhle, und die Centralhöhle, welche in vier Canäle sich verzweigt, in die Canäle der beiden Knospen, des Deckstücks und des Polypiten. Das Entoderm, welches alle diese Höhlräume auskleidet, ist eine einschichtige Lage von Flimmerepithel. Dasselbe erscheint bei durchfallendem Lichte bräunlichgelb, bei auffallendem Lichte spangrün gefärbt. Der Luftsack selbst ist rings von den hellen Zellen des Nahrungsdotters umgeben, und steht nur an seinem proximalen Ende (der Abschnürungsstelle) in Berührung mit der Wand der Polypitenbasis, welche daselbst in das Deckstück übergeht."

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* *Op. cit.*, p. 58.

In the genus *Agalma* Metschnikoff thus describes the appearance of the float on the fifth day. He says:* "Zu gleicher Zeit bemerken wir dicht unterhalb des Deckstückes, auf der Fläche, die ich als Rückenfläche bezeichne, eine locale Ectodermverdickung, welche als erste Spur des Luftapparates angedeutet werden muss. Am sechsten Tage hat sie die Form eines halbkugeligen Körpers angenommen, der unter der äusseren Ectodermbedeckung und in der Nähe des einstweilen noch localen Entoderms seine Lage findet." The origin of the float in *Agalma elegans* resembles more closely that of *Agalma Sarsii* than that of *Crystallodes.* It arises as a simple epiblastic elevation of the yolk surface, not far from the proximal side of the hydrophyllium. That elevation is primarily of epiblast, but later the hypoblast may also enter into its formation. As the float grows older, the bud diminishes in size, thickening inward, and a separation of the hypoblast from the epiblast takes place, which is filled by an intermediate body, either thickened epiblast or the intermediate or middle layer. The subsequent growth of the float will be seen in descriptions of later stages of the primitive larva.

In Fig. 13 we find that the primitive hydrophyllium has increased very much in size, while in the progress of that growth the distinction between the proximal and distal edges of the disk which we have earlier detected are still maintained. The great body of the scale is gelatinous, the mass of which is formed by an enormous growth of a middle layer (*mb.*), which lies between epiblast and hypoblast. The relative thickness of the epiblast has greatly diminished. It is still ciliated and easily distinguished from the other layers when seen in profile and along the rim of the hydrophyllium, while scattered over the surface of the scale appear the small epiblastic structures or nuclei (?). The forming covering-scales called serrated hydrophyllia (*ser. hyph.*) have a slightly red color.

The primitive cavity (*c. p. l.*) lined with hypoblastic cells which have a distinct yellow color has risen with the growth of the bell, and extends towards the distal rim of the hydrophyllium. The edges of the disk are free, the hydrophyllium fitting over the egg like a helmet, the visor being represented by the distal border. In the proximal region of the primitive hydrophyllium we find that the epiblast and hypoblast have separated from each other, and that between them has formed a layer or cellular mass representing the great gelatinous mass of the medusa bell. Outside of it is the epiblast, while lining the cavity is the hypoblast. The latter layer can be traced from the lining of the primitive cavity for some distance over the surface of the yolk cells under the epiblast. The epiblast can also be traced from the superficial position on the yolk over the surface of the hydrophyllium. I find by a comparison of this figure with those by Metschnikoff representing the first appearance of the float, that it most closely approaches his Fig. 6, Pl. VIII. In his figure, however, we miss a representation of the inner hypoblast between the bud which forms the float and the yolk cells which were seen in the stages here figured. Comparing, however, his Fig. 5 of the same plate with his Fig. 6, we find in the latter an ectodermic bud but no hypoblast, while in the former a layer continuous with the lining of the primitive cavity lies under the epiblast where the float is developed. His Fig. 6 represents the origin of the float as far as the epiblast goes like mine, but we miss in it a deeper layer of hypoblast which is probably present. The epiblast at this stage probably divides into a superficial and a deeper portion. It is suggested that the latter is the same as the middle or gelatinous layer of the medusa bell.

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* *Op. cit.*, p. 50.

Under the visor at the distal rim of the helmet-shaped hydrophyllium of Fig. 13 the layer of epiblast is thicker than in most other regions, and has a reddish color. Its surface is rough by reason of elevations, which are probably superficial, uprising from the epiblast. At this point, or near by, the serrated hydrophyllia (*ser. hyph.*) characteristic of the second larval stage of *Agalma* first appear. The diameter of the primitive hydrophyllium from distal to proximal border is .40 mm.; its elevation above the yolk, .15 mm. The diameter of the egg is .47 mm. These larvæ were picked out of the water in which the *Agalmata* were confined at six o'clock, August 8th. The hydrophyllium naturally floats downward in the water, the yolk being apparently lighter.

Primitive Larva. — The maximum development of the primitive or larval hydrophyllium is reached in the next stage, represented in Fig. 14. In this larva the yolk of the egg is still spherical, and little reduced in size, notwithstanding the enormous growth of the scale from it. The helmet-shaped hydrophyllium almost completely invests the ovum. The bounding planes of the irregular polygonal cells of segmentation are clearly to be seen through the side of the hydrophyllium, and the enveloping layers of the yolk are traceable over its whole surface. Within the segmented yolk cells appears the protoplasmic network (*vt. c.*) which dates back to the original ovum in the gonophore. The primitive hydrophyllium is seen fitting over the ovum like a helmet, which, although fastened to it at the germinative pole, is free on the sides. Its border and sides cover about two thirds of the yolk which is here represented through the transparent lateral walls.

The primitive hydrophyllium is transparent, slightly reddish in certain regions, its great bulk being gelatinous. The following distinction between the distal and proximal rim can be easily seen when in profile. The wall of the distal edge, which corresponds to the visor of the helmet of our former comparisons, is much thicker than the opposite, and more rounded. The proximal rim ends in a sharp angle, and its walls are very thin. In a figure of this stage we have the larva represented as if we were looking at it from the left-hand side as defined above. Over the surface of the primitive hydrophyllium is spread a single layer of thin polygonal cells of the epiblast, which are seen in profile around the rim of the bell and on its bounding lines, even on the inner surface adjoining the yolk sac. Over the external surface the prominent nuclei of the same cells can be readily traced, dotting it at intervals, and in places well-defined cell-walls can be faintly seen. The layer from which these cells came, or the epiblast, was one of the first layers to form, and throughout the growth it has been gradually becoming relatively thinner and thinner. Although the bodies called nuclei of these cells are very well marked in *Agalma elegans*, I do not find them represented in the figures which have been published of other species of the genus *Agalma*, or *Crystallodes*. The remnant of that cavity, which has been called the primitive cavity, is now a tubular body with thickened hypoblastic walls of yellow color, and extends from the base of the float towards the distal portion of the hydrophyllium.

At this stage in the development of the primitive hydrophyllium it was observed that from the nuclei of several of the epiblastic cells, situated on the surface of the hydrophyllium above the fundus of the cavity, there were thread-like extensions, probably protoplasmic, which connect the surface of the larva with the hypoblast of the cavity. At times the surface of the hydrophyllium from which these threads arise is depressed as if forcibly drawn back by them. In a few instances the threads end blindly in the gelatinous layer at a point not more than half-way from the epiblast to the cavity. These threads sometimes have a close resemblance to certain similarly placed threads in worm larvæ, as in the well-known *Tornaria*, where they extend from the cavity of the larva to an apical cluster of modified epiblastic cells through an intermediate gelatinous layer. I was unable to observe these threads closely enough to detect any tubular structure in them. Later in the growth of the larva there are two filiform bodies connecting the cavity of a hydrophyllium with its surface, which may possibly be the same as the thread-like extensions of which we have already spoken. In the development of *Agalma Sarsii* as figured by Metschnikoff, we have no representative of these threads in the primitive larva, or in stages of later growth. Hæckel figures certain structures in the hydrophyllium of *Physophora* which have been found by me in *Agalma*, which in *Physophora* have the form of small tubes extending from the cavity to the surface. These call to mind the protoplasmic bodies in the primitive hydrophyllium of *Agalma*, although they are different in many respects. Hæckel gives them a morphological significance in *Physophora*, and regards them as comparable with certain parts of the chymiferous radial tube system of hydroid gonophores. He does not represent them in the younger forms, at least, of the primitive larva of *Crystallodes*. Cilia were not observed on the outer surface of the primitive covering-scale, but were seen on the epiblast covering the yolk at this age.

Of the remaining structures found in the primitive larva the most important in the future history is a spherical organ (*pn. cy.*) adjacent to the end of the primitive cavity. This body is the future float, and at this stage lies inside the egg, or between the yolk cells and the superficial covering, although no marked external elevation could be seen. The float is enclosed by a layer of cells which was traced continuously into the hypoblast of the primitive cavity, and also into the hypoblast which covers the yolk sac. Within the hypoblast the contents of the float and the hypoblastic layer were slightly separated. A continuation of the same layer, epiblast, reflexed from the inner surface of the covering-scale, extends over the float and is continued over the surface of the egg.

A second appendage, which assumed the form of a slight projection from the surface of the yolk on the left-hand side of the cavity of the primitive hydrophyllium, is also present in this stage of the primitive larva. In profile this structure (*ser. hyph.*) is arch-shaped, and has a slightly reddish color. It is the beginning of a covering-scale which, although provisional in nature, has given the name of "Athorybia stage" to a larval condition of *Agalma* which follows the first or primitive larva. On the right-hand side of the cavity of the primitive hydrophyllium is a cluster of cells of red color, which is the beginning of a second similar serrated hydrophyllium. This latter cluster, however, has not raised itself any considerable amount above the surface of the yolk. The longest diameter of the primitive hydrophyllium in Fig. 14 is .75 mm.; the thickness at the distal side, .17 mm. The length of the primitive cavity is .25 mm.; its breadth is .10 mm. The float is almost .10 mm. in diameter. It will be seen from these measurements that the scale has now reached a very great size as compared with its dimensions in earlier larvæ. It has now the maximum size to which it ever attains.

Fate of the Primitive Hydrophyllium.

It is known that this primitive hydrophyllium is a temporary or embryonic structure; but its fate, whether it is simply thrown off or absorbed, is not at present definitely made out. Both Hæckel and Metschnikoff have pointed out that it is a provisional structure, but neither has traced it far enough in the last phases of its history to satisfactorily show whether it is simply discarded, absorbed, or passes with external changes of outline into some other structure. The most definite statement which we have is as follows. Metschnikoff says, "das erstgebildete kappenförmige Deckstück abgeworfen wird" in the genus *Agalma.*

The primitive hydrophyllium of *Agalma elegans* suffers many modifications in external form in some of the older stages; but whether these modifications were abnormal, resulting from the fact that the animal is in confinement, was not determined. It seems to me more natural to suppose, that, instead of being thrown off in the subsequent stages, the primitive covering-scale passes by a few modifications in its external contour into some other organ, probably a differently formed covering-scale.

Fig. 15 represents the larva of *Agalma* on August 10, four days after the capture of the parent. This larva was picked out of the water, in which it was freely swimming below the surface. The figure represents the larva as seen from that pole which is opposite the germinative pole, so that the various organs which have appeared near that region are seen through the yolk contents. This position, assumed while the egg is floating, is that which is best adapted to exhibit the newly forming organs in their relation to the cavity of the primitive hydrophyllium.

We recognize in this stage many organs which have already been described, and one or two new ones lately formed. In the first place, the yolk — a prominent spherical mass of polygonal segmentation spheres with the internal protoplasmic network — should be mentioned. This occupies most of the middle portion of the figure. Around it in profile the epiblastic and hypoblastic layers, of which the former is ciliated, may be seen. The larger, more transparent body, seen above and on either side of the yolk, is the projecting primitive hydrophyllium. This distal portion of this scale is represented at the top of the figure, the proximal at the lower part, while the right hand of the figure is the left of the scale, following the nomenclature of previous descriptions. The nuclei of the epiblast and the polygonal outlines of the epiblastic cells are easily seen here and there over the surface of the scale. The cavity (*c. p. l.*) of the primitive larva has two or more thread-like structures (*fil.*) extending from its hypoblastic lining to the nuclei of epiblastic cells. The hypoblast of the primitive cavity has a yellow color, especially well marked at its distal end, where its walls are likewise covered with small pigment dots, black, or nearly so, in color. At the opposite extremity of the primitive cavity, near the float, it ends in a closed cone-like termination, which is hidden by the float in the figure.

It is perhaps needless to say, that the spherical body near the middle of the figure is the float, seen through the yolk contents; and that on the right and left sides of the primitive cavity are two buds, which later develop into the serrated hydrophyllia characteristic of the Athorybia stage. In both of these can be recognized a very thick outer layer, which is probably the middle gelatinous layer, over which is spread a thin layer of epiblast, and an inner thinner layer, which is hypoblast. Within this last layer in each case we have a cavity which is the beginning of the future tube which penetrates the scales. A considerable quantity of reddish pigment is found in the yolk in the immediate neighborhood of the last-mentioned organs. It is very difficult for me to formulate any law for the relative position in which the successively appearing buds of the larva of the *Agalma* develop. We know that in the adult *Agalma* those nectocalyces which are nearest the float are the youngest, and that the newly formed organs of this name always develop between those already formed and the float.

Fig. 2, Pl. IV. represents a very instructive stage in the development of the primitive larva, which was taken on August 9 at noon, or on the third day after the capture of the adult. It is seen in a little different plane from the preceding, but in such a way that the organs already mentioned can be easily distinguished. We have in this stage an addition of most important character, for at this time first appears the beginning of the polypite. The larva is shown in such a way that the embryo is twisted somewhat as compared with former stages, and the hydrophyllium has its proximal edge so turned into view as almost completely to cover the yolk. By this new position of the larva the conical end of the primitive cavity near the float is well shown, while the two buds which later form the serrated hydrophyllia are thrown to one side. The most developed of these last-mentioned organs has a spatulate form, and shows the three layers, epiblast, middle layer, and hypoblast, as well as a cavity which occupies most of the interior of the organ. The other hydrophyllium is not as well formed, and is more highly colored.

In addition to the buds which have been mentioned as already formed, we have represented in this stage a significant thickening (*pyt.*) at one pole of the two layers which surround the yolk of the egg. This pole is situated in a point at right angles to that where the bud which forms the float first appears. The elevation of these two layers takes the form of a simple bud comparable with other buds of the primitive larva, and ultimately forms the first or primitive polypite of the *Agalma*. The elevation of the primitive polypite is reddish yellow and ciliated, with the lower layer slightly separated from the cells of the yolk. Although the point at which the polypite in *Agalma* develops is very different from that at which the same organ of *Crystallodes*, as recorded by Hæckel, arises, these differences are not too great to have a similar morphological interpretation. Like all organs or parts of the *Agalma* body, the polypite originates as a three-layered bud from the surface of the yolk. Like them also it separates from the yolk-cells, leaving a cavity between the hypoblast and vitelline cells. A part of those walls of the yolk which enclose the yolk-cells becomes the outer wall of the float; another part is modified into new buds, which develop into tasters, hydrophyllia, and tentacles; and still another part forms the walls of the first-formed polypite. Can we not consider that the yolk-sac in this case, as in *Crystallodes*, is not changed into the polypite, as in *Physophora* and some other genera?

From Fig. 16, Pl. III., taken five days after the capture of the *Agalma*, we may obtain a somewhat better idea of the relationship between the buds which form the float, the serrated hydrophyllia, and the first-formed polypite. In the view of the larva as here seen, we are looking at the larva from the side opposite that on which the primitive hydrophyllium is attached. The primitive cavity is thus thrown behind the yolk, and is concealed by the buds which have already appeared, one of which is shown in profile. The larva is placed in what is considered its normal position comparable with the natural position of the adult. The float is well developed, and resembles closely that of the adult. Below it there is a well-marked red pigment-spot on the external walls of the ovum, which forms a convenient point for the orientation of other organs, and which itself forms in later stages a well-known organ (embryonic tentacle); and at the pole of the egg opposite the float we find the partly formed polypite. The lower part of the large transparent body behind the yolk is the distal rim of the hydrophyllium; the upper part is the proximal border. The axis of the future *Agalma* is thought to pass lengthwise through the float, and to cut also that pole of the yolk at which the polypite is forming.

The axis of the larva, as thus indicated, does not coincide with that which originally passes through the egg from the point at which the first elevation of epiblastic and hypoblastic layers took place to the opposite pole. It is apparently at right angles to this. If I am right in regard to the relationship, or, to use a stronger word still, the coincidence, of the former axis with the first plane of cleavage in the unsegmented ovum, the axis of the adult *Agalma* is at right angles to the first plane of cleavage. It may be mentioned at this point, that in the gonophore, as the egg first forms, the axis of the ovum passing through the red pole and the point of attachment of the gonophore is normally at right angles to the axis of the *Agalma*. The horizontal diameter of the larva at this stage is .70 mm. The vertical diameter is .75 mm. The longer axis of the ovum is .45 mm.; the shorter, .35 mm.

Fig. 1, Pl. IV. is taken from a larva a little older than the last, but still five days old. It resembles the young *Agalma Sarsii* at the close of the second week. The axis is placed vertical in the same position as that of the adult as usually represented. The separation of the hypoblast from the yolk-cells has left a cavity of relatively considerable size at the point where the polypite has begun to form. This cavity recalls a similar cavity in the larva of *Crystallodes* as figured by Hæckel. There is as yet no apparent diminution in the size of the primitive hydrophyllium, and the outlines of the epiblastic cells upon it can be easily traced. The yolk-cells still enclose the protoplasmic network, and have the same polygonal shape as earlier in their history. The float is more elongated and lies on one side of the yolk. It is filled even in this larva with air or gas. Below it is a mass of reddish pigment concentrated in a cluster. The size of this larva is about the same as that of the last.

On August 13, seven days after the *Agalma* had been placed in the water, I was surprised to see, on looking for my larvæ through the walls of the glass vessel in which they were confined, that they had very much decreased in numbers. This led to the discovery that, whereas up to about this date they were found at all depths in the water, the larvæ are now to be seen only upon the surface. They often cluster together there, and the size of the float imparts to them a silvery color, like a small bubble of air resting on the water. The reason why the larvæ seek the surface at this phase of their development probably is, that the float has grown so large, or that the size of the primitive hydrophyllium has diminished. Whatever may be the cause which led the *Agalmata* to come to the surface, an effect which can probably be ascribed to the two causes mentioned above combined, we find that the size and general outlines of the first-formed covering-scale have undergone several modifications. Fig. 5, Pl. IV. shows a larval stage taken August 13th, in which the size of the scale is much smaller than in the larvæ already described. It is found at this time in the life of the larva that the border of the covering-scale has a tendency to draw together, and its surface becomes grooved or furrowed. In Fig. 6 we see a continuation of the same process, and in Fig. 7 still more reduction in the size of this body. One or two structural features have led me to regard the flat angular body on the yolk of these larvæ as the primitive hydrophyllium reduced in size. The tube which is found in the primitive scale, especially at the marginal termination, has a yellow color with black dots. These figments were found in the tube of the more reduced scale in its present condition. The small nuclei spread over the surface of the primitive hydrophyllium, called in our above description the nuclei of the epiblast, are easily recognized on the surface of the modified scale. With the reduction in external form of the plump walls of the first-formed scale, or primitive hydrophyllium, there has taken place also a change of form in its internal cavity. At the distal border of a scale represented in Pl. IV. fig. 8, the tube of the scale has bifurcated and extends in two divisions to the bell rim, where both end in the neighborhood of clusters of large nematocysts or lasso-cells. A yellow color was observed at these points, although the tube of the scale throughout most of its course is not as markedly colored. The small cell-like spots which appear on the surface of the scale and resemble the nuclei of the epiblast as already described, are well marked on the ridges of the scale.

I have been unable to identify a scale of this kind with any of those figured in the larval stages of *Agalma* as described by Metschnikoff. Hæckel, however, figures a similar scale with divided tube in *Crystallodes*, but from his descriptions it does not follow that he regards it as the modified primitive scale. In *Physophora,* however, we find an approximation in shape to this scale in the primitive hydrophyllium, and moreover in this genus, as in mine, there is a smaller tube extending from the cavity of the scale to the surface, and ending in or near clusters of lasso-cells superficially placed. If the first-formed scales (primitive hydrophyllia) in both *Physophora* and *Agalma* are homologous, we may find the smaller bifurcations connecting the cavity of the scale in *Agalma* with its surface to be the same as the similar structures described by Hæckel in the young *Physophora,* provided, of course, that the flat scale of Fig. 8 is the modified primitive covering-scale of Pl. III. fig. 14. The flat scale (fig. 8) is certainly different in the contour and course of the central tube from the serrated hydrophyllia, and no other structure is thought of to which to refer it except the primitive hydrophyllium, that large covering-scale whose origin dates back into the youngest stages of the larva. What has already been here written of the modifications in form which the first-formed covering-scales go through, does not of course show that in the end it may not be simply cast off. My studies throw no light on this point. If it is ultimately dropped it undergoes modifications in outline before the consummation of that event.

Cambridge, July, 1885.

EXPLANATION OF THE PLATES.

br.	Bridge connecting two segmentation spheres.
cav.	Cavity.
cl. pl.	Cleavage plane.
1 *cl. pl.*	First cleavage plane.
2 *cl. pl.*	Second cleavage plane.
3 *cl. pl.*	Third cleavage plane.
c. p. l.	Cavity of primitive larva.
dm.	Thickening of the superficial layer.
eb.	Epiblast.
ct.	Undivided portion of ovum.
fil.	Filament.
goph.	Gonophore.
gt.	Oil globule.
hb.	Hypoblast.
hyph.	Hydrophyllium.
m.	Membrane.
mb.	Mesoblast.
n.	Nucleus.
nl.	Nucleolus.
om.	Ovum.
pg.	Polar globule ?
pig.	Pigment spot.
pr.	Primitive furrow.
pr. hyph.	Primitive hydrophyllium.
pn. cy. *py. cy.*	Pneumatocyst.
pn. ph.	Pneumatophore.
pyt.	Polypite.
r. pol.	Rosy pole, when not indicated, upper pole of figure.
r. tb.	Radial tube.
sc.	Secondary furrow.
ser. hyph.	Serrated hydrophyllium.
1 *ser. hyph.*	First serrated hydrophyllium.
2 *ser. hyph.*	Second serrated hydrophyllium.
tb.	Tube.
ubr.	Umbrella.
vel.	Velum.
vt.	Vitellus.

vt. c. Vitelline cells forming a "protoplasmic network" through the yolk contents. In many of the figures only a few of these cells are drawn. They are found throughout the whole contents of the egg.

y. Unknown body, possibly remnant of membrane which encloses the egg.

All the figures, with the exception of Pl. IV. figs. 3–7, were drawn by the author with an Oberhäuser camera, objective B. B., eye-piece 2, Zeiss. Size reduced one half in photography. All figures except Pl. II. fig. 2 were drawn from living eggs and larvæ. The last mentioned was treated with dilute acetic acid before drawing.

PLATE I.

Fig. 1. Immature female gonophore with egg in the interior. Nucleus and nucleolus shown through its walls. Attached to parent.

" 2. Egg in a small immature gonophore, with sinuses between ovum and bell walls of gonophore.

" 3. Female gonophore found free in water. Enclosed ovum .5 mm. in diameter.

" 4. The ovum in the act of escape from the gonophore.

" 5. Ovum removed from a gonophore (artificially).

" 6. Ovum just escaped from gonophore (naturally), .45 mm. in diameter.

" 7. Egg showing the formation of a primitive furrow at one pole.

" 8. The same, ten minutes older than last.

" 9. The same, fifteen minutes older.

" 10. The same, twenty minutes older.

" 11. The same, twenty-five minutes older.

" 12. The same in two-cell stage, thirty minutes older than Fig. 7. Diameter .35 mm. The egg traced from Figs. 7–12 is .1 mm. smaller than that from Fig. 13 on.

" 13. Two-cell stage with beginning of a secondary furrow (*sc.*), .60 mm. in long diameter, .43 mm. in least diameter.

" 14. Two-cell stage, ten minutes older than Fig. 13. .60 mm. in diameter.

" 15. The same, fifteen minutes older.

" 16. The same, eighteen minutes older.

" 17. The same, twenty minutes older.

" 18. The same, twenty-five minutes older, showing the formation of the secondary furrow, extending in a horizontal direction over the surface of the ovum. It also shows the deviation of the primary cleavage plane (1 *cl. pl.*) from a straight line when seen in profile.

" 19. Formation of a 4-cell stage by the closing in of the secondary furrow (*sc.*). The furrow is still open at each end. Thirty minutes older than Fig. 13, .50 mm. in diameter.

" 20. Four-cell stage, thirty-five minutes after Fig. 13.

" 21. The same, forty-five minutes after.

" 22. The same, fifty-five minutes after.

" 23. The same, one hour and ten minutes after.

PLATE II.

Fig. 1. Four-cell stage, two hours after Pl. I. fig. 13.
" 2. The same, two hours and five minutes after.
" 3. Segmented ovum showing the beginning of the tertiary furrow (3 *cl. pl.*), two hours and fifteen minutes older than that represented in Pl. I. fig. 13.
" 4. Four-cell stage, two hours and twenty minutes older.
" 5. The same, two hours and twenty-five minutes older.
" 6. Older stage, two hours and thirty minutes after Fig. 13. .50 mm. in diameter.
" 7. Segmented ovum, two hours and forty minutes older than Fig. 13.
" 8. Superficial granular layer (*dm.*) formed on the segmented ovum. Planula ? .45 mm. in diameter.

PLATE III.

Fig. 1. Segmented egg with a marked increase of thickness of superficial layer at *dm.* .54 mm. in diameter.
" 2. The same, treated with acetic acid (two layers at pole, *cb.*, *hb.*).
" 3. An older egg, in which the thickness of the two layers is more marked. .60 mm. in greatest diameter.
" 4. The same, older.
" 5. The same, still older, showing the cavity of the primitive larva (*c. p. l.*).
" 6. A portion of the egg and the growing protuberance at its pole.
" 7. The same, older.
" 8. An older larva, with constriction between the scale and the surface of the ovum.
" 9. The same, older. The right side of this figure corresponds with the left of preceding and following figures, except in Fig. 12.
" 10. Embryo of about the same age as the last, reversed.
" 11. Embryo found in water, August 8 (adult put in August 6), a little older than the last.
" 12. Embryo still older.
" 13. The same, older, .47 mm. in diameter.
" 14. A primitive larva taken on the third day after the capture of the adult (72 hours old ?), .70 mm. in diameter.
" 15. A larva a little older than the last, seen from the pole opposite that on which the primitive hydrophyllium is formed. The larval appendages are therefore for the most part seen through the yolk.
" 16. A larva so placed that the axis of the future *Agalma* is almost vertical. The union of the primitive hydrophyllium and the yolk is on the side of the yolk turned away from the observer. Older than last.

PLATE IV.

In none of the figures are the vitelline cells and the nuclei of the thin epiblastic layer of the primitive hydrophyllium brought out with sufficient distinctness. There should be two layers instead of one at *pyt.* in Figs. 1, 2, and 3.

In Figs. 2 and 4 the wall of *c. p. l.* is too black, and does not show the thickness of the hypoblast. The rows of nematocysts on the surface of *hyph.*, Fig. 8, are not well shown. The clusters of nematocysts at the margin of *hyph.* after the bifurcation of *tb.* are faulty. The cilia on the surface of the ovum, well seen in Fig. 2 at *pyt.* in my drawing, are not found in the photographic reproduction.

Fig. 1. A larva (primitive larva) in about the same age as the last and in a like position, except that the primitive covering-scale or hydrophyllium is turned a little more to the plane of the observer.

" 2. The same, looking through the primitive covering-scale upon the apex of the float, which lies in the geometric centre of the figure. Three days old.

" 3. Older larva, free-hand drawing, showing growth of serrated scale (*ser. hyph.*).

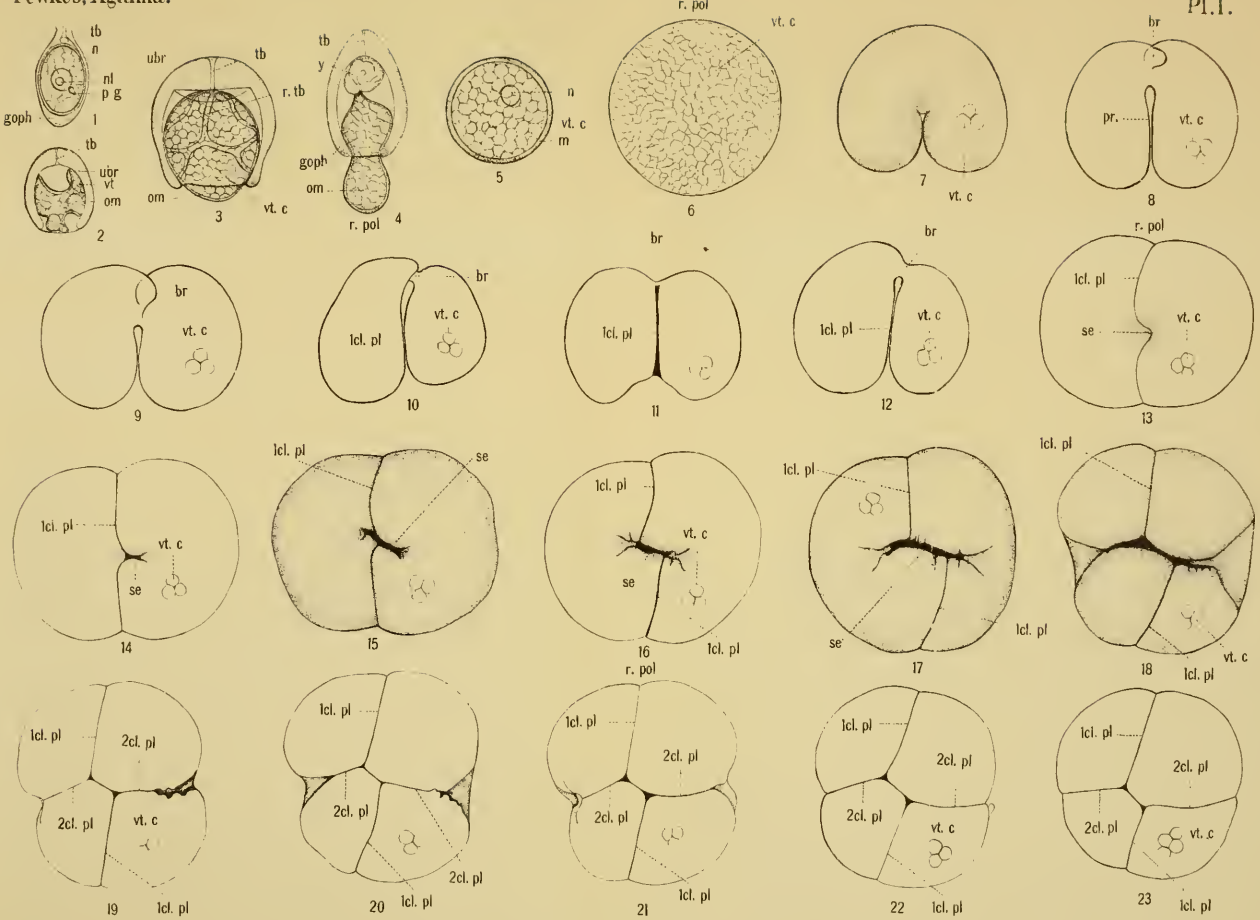
" 4. The same, lateral view.

" 5–7. Successive stages, in reduction in size of the primitive hydrophyllium, following its great development.

" 8. A larval *Agalma*, one week old, bearing a large flat hydrophyllium (remnant of the primitive covering-scale) through which runs a tube (*tb.*) which bifurcates and ends at the distal edge in clusters of nematocysts.

Fewkes, Agalma.

Pl. I.



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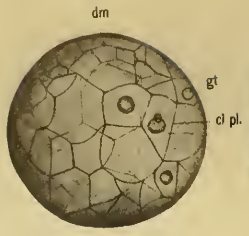

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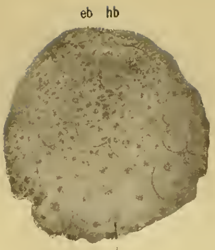

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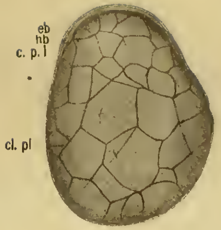
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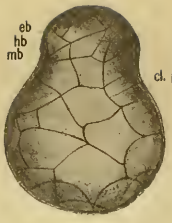
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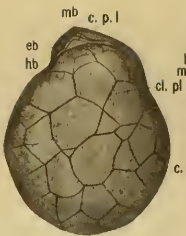
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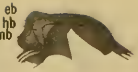

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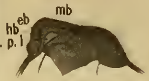

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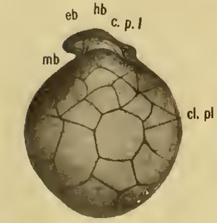
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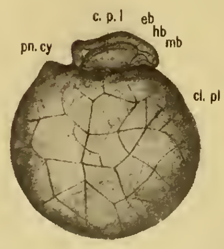
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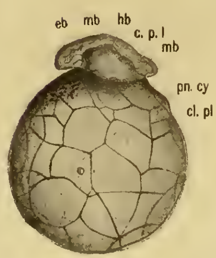
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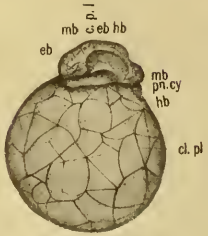
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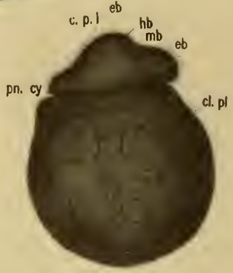
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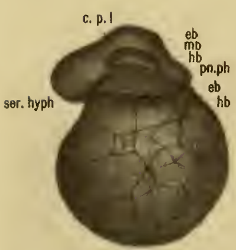
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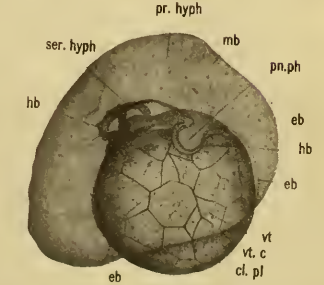
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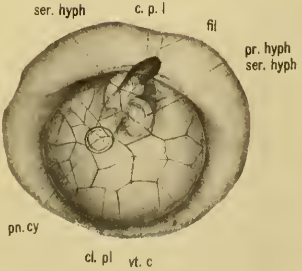
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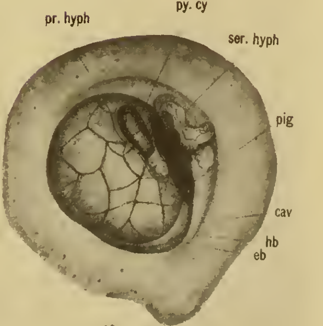
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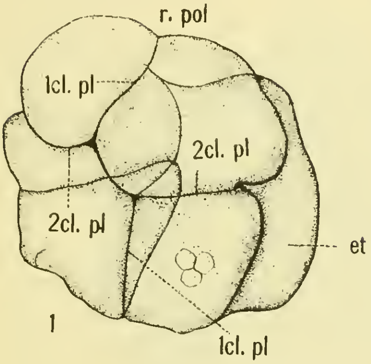
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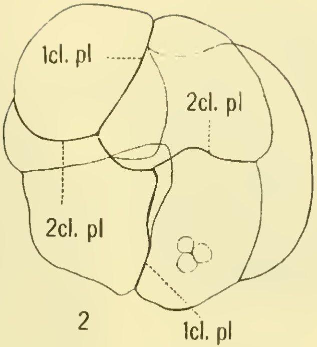
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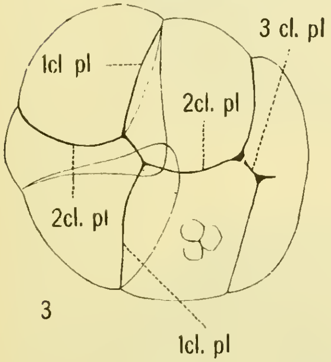
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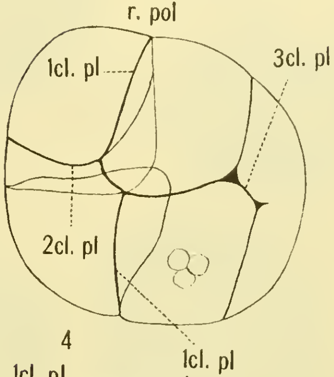
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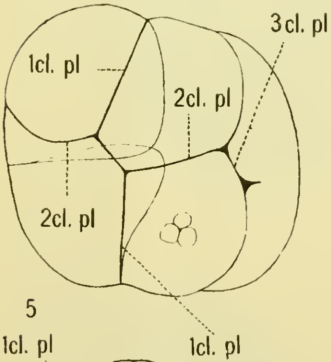
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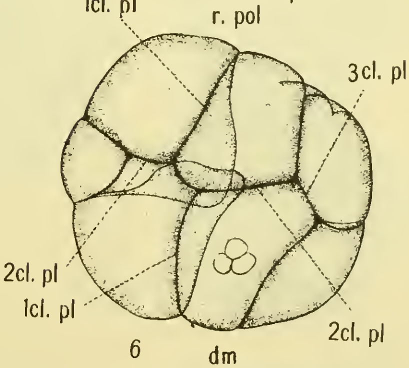
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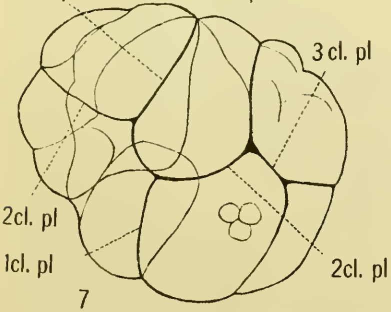
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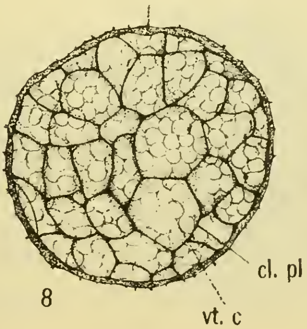

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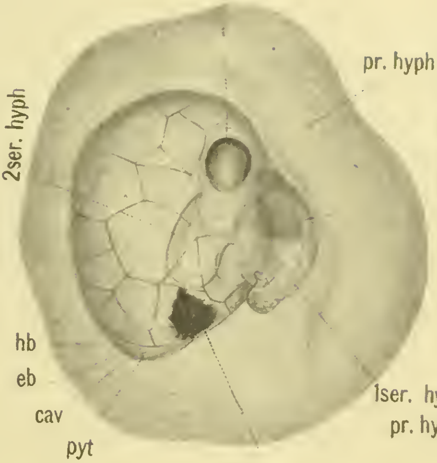
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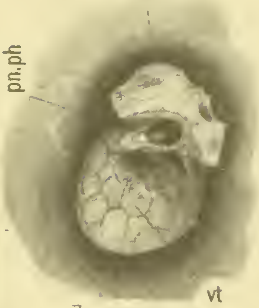
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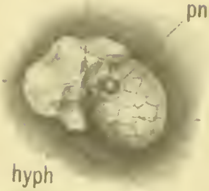
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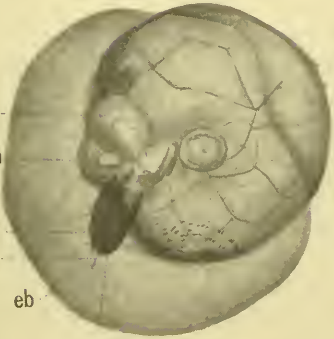
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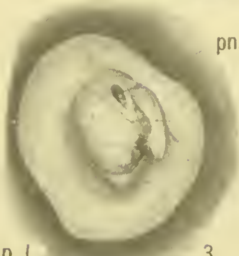
2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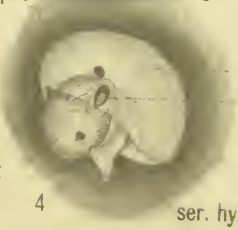
3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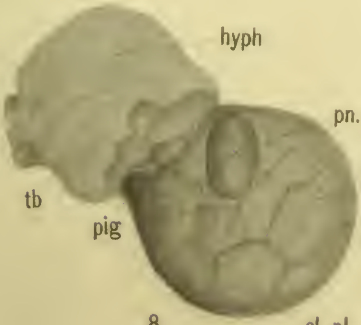
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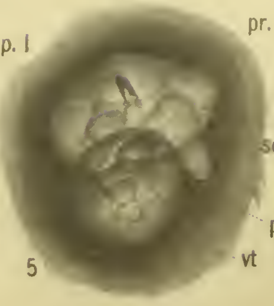
8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5

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